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BY
IDONGESIT WILLIAMS

DISSERTATION SUBMITTED 2015

AALBORG UNIVERSITY
DENMARK

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by

Idongesit Williams

AALBORG UNIVERSITY
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Dissertation submitted

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CV

Idongesit Williams, er i øjeblikket og Extern lektor og Ph.D-stipendiat ved Aalborg Universitet København. Han tog sin kandidatgrad i informations- og kommunikationsteknologier fra Aalborg Universitet København i 2010 og en bachelorgrad i fysik fra University of Uyo, Nigeria i 2005. Hans forskningsområde er i IKT for Udvikling, udbredelse og vedtagelse af IKT. Hans fokus for de sidste fire år har været på bredbånd infrastrukturudvikling i landdistrikterne. Han har 15 publikationer til hans ære, herunder konference publikationer, journal publikationer, bøger og bogkapitler.

Idongesit Williams, is currently and Extern lektor and Ph.D Fellow at Aalborg University Copenhagen. He earned his Master degree in Information and Communications Technologies from Aalborg University Copenhagen in 2010 and a bachelor degree in Physics from the University of Uyo, Nigeria in2005. His area of research is in ICT for development, the diffusion and adoption of ICTs. His focus for the past four years has been on Broadband infrastructure development in rural areas. He has 15 publications to his credit, including conference publications, journal publications, books and book chapters.

ENGLISH SUMMARY

The Universal Access and Service of Broadband infrastructure and service respectively has been hampered by the commercial un-viability of rural areas to market forces. Universal Access denotes the universal coverage of telecom infrastructure in a geographical area. Universal Service denotes the level penetration of telecom service within a population or at household level within a geographical area. To supplement the market forces and ensure Universal Access, this research investigates into how Public-Private Interplay (PPI) can facilitate Universal Access of Broadband infrastructure. The point of departure here is that the PPI is used to facilitate bottom-up approaches to Broadband infrastructure development. Extensive discussion on Universal Access and Universal Service, the utilization of PPIs in facilitating both top-down and bottom -up and approaches to Broadband/telecom infrastructure are discussed in chapters 2, 3 and 4.

This is an exploratory, multi-case study qualitative research. The case study comprises of the primary case study and the secondary case study. The primary cases are namely: Magnolia Road Internet Coop (USA), Djurslandsnet (Denmark), Hallaryd Broadband Coop (Sweden), Almhult Municipality Broadband Initiative (Sweden), Johannesburg Wireless User Group (JAWUG) (South Africa), Dharamsala Wireless Network (owned by Airjaldi, India) and Wireless Ghana Project (Ghana). The secondary case study comprised of universality funds of countries with a greater rural population who still utilize universality funding to facilitate Universal Access and Service of Broadband infrastructure and service. The first case was the Ghana Investment Fund for Electronic Communication (GIFEC), the Universality funds in Ghana. The second case was the Universal Service Provision Fund (USPF) Nigeria.

The primary case studies produced different outcomes based on the theory utilized. The Actor Network Theory analysis revealed that people in rural areas, if properly motivated can facilitate cost-effective Broadband Internet solutions for themselves. The result was valid for developed and developing country cases. Results of the Grounded Theory analysis revealed that people in developing countries are likely to implement Broadband Internet infrastructure, if they had the vital resources to implement the infrastructure, they could see the usefulness of the technology and service to them. Another factor was their ability to see the actual usefulness of the technology via a demonstration. In the developed countries, rural dwellers were likely to implement Broadband Internet infrastructure if they could see the possibility of developing the infrastructure themselves, if they possessed the vital resources needed to deploy the infrastructure and if they felt the technology was useful to them. These results led to the development of the developed and developing country models. These models are useful tools that can help in mobilizing people in rural areas. Results from the secondary case study revealed that in Nigeria, the Private Design-Build-Operate was prevalent, while in Ghana the Public Design-Build-Operate was prevalent. Both universality funds are keen on bottom-up approaches to supplement the top-down approach. The application of the Stakeholder Theory in both cases revealed that certain stakeholders identified in the primary case, such as cooperatives, NGOs, social enterprises, etc., are legitimate stakeholders to the universality funds of both countries.

The overall outcome of the research is the design of the PPP/PPI model and the Municipality Mediated Model aimed at facilitating rural Broadband infrastructure development in developed and developing countries.

Keywords: Public-Private Partnership, Broadband, Rural Areas, Universal Access, Infrastructure Development

DANSK RESUME

Emnet for denne afhandling er, hvordan man kan stimulere udbredelsen af bredbånd i yderområder, der ikke er dækket af bredbånd. Yderområder er i denne forbindelse defineret som områder, hvor det i dag ikke er rentabelt at investere i en fuldt dækkende bredbåndsinfrastruktur. Det undersøges, hvordan man kan stimulere investeringerne i bredbånd i disse områder gennem et offentlig-privat samarbejde – OPS (engelsk Public-Private Interplay eller PPI). OPS er her anvendt i stedet for OPP (offentlig-privat partnership), idet OPS er et bredere begreb, der også omfatter mindre formelle samarbejdsformer. Der skelnes her mellem en top-down approach, hvor initiativet kommer oppefra, og en bottom-up approach, hvor udgangspunktet er lokale initiativer, der kan understøttes gennem et offentligt-privat samarbejde.

Begrebsligt skelnes i denne rapport yderligere mellem universel adgang og universel service. Universel adgang betyder, at et givet geografisk område er dækket af en bredbåndsinfrastruktur, således at det for alle er teknisk muligt at få en bredbåndsforbindelse. Universel service relaterer til den faktiske udbredelse af bredbånd, dvs. at alle (eller i hvert fald en høj andel) rent faktisk er tilsluttet bredbåndsnettet med tilhørende tjenester.

Studiet anvender en eksplorativ og kvalitativ multi-case tilgang. Der er udarbejdet et antal primære casestudier: Magnolia Road Internet Coop (USA), Djurslandsnet (Danmark), Hallaryd Broadband Coop (Sverige), Almhult Kommune (Sverige), Johannesburg Wireless User Group (JAWUG) (Sydafrika), Dharamsala Wireless Network (ejet af Airjaldi i Indien) og Wireless Ghana Project (Ghana). Herudover er der lavet to sekundære casestudier, der undersøger anvendelsen af en universel service fund som et middel til at udbrede bredbånd generelt. Det ene sekundære casestudie omhandler Ghana Investment Fund for Electronic Communication (GIFEC) i Ghana. Det andet omhandler Universal Service Provision Fund (USPF) Nigeria.

I de primære casestudier blev der anvendt to forskellige teoretiske tilgange, som hver især producerede forskellige resultater. Aktør-netværksteori er blevet anvendt til at påvise, at både i ulande og i ilande kan et motiveret lokalsamfund facilitere etableringen af en velfungerende bredbåndsinfrastruktur i det pågældende område. Grounded Theory blev anvendt til at identificere betingelser, der er afgørende for, at et sådant projekt kan realiseres i et udviklingsland. De nødvendige betingelser blev identificeret som: 1) lokalsamfundet skal have adgang til vitale ressourcer 2) teknologien skal have en nytteværdi, der er synlig for lokalbefolkningen. Nytteværdien kan f.eks. synliggøres gennem realiseringen af demonstrationsprojekter. Et lignende sæt af betingelser blev identificeret for projekter i ilande.

Disse resultater er anvendt til at lave to forskellige udviklingsmodeller for, hvordan man kan mobilisere lokale ressourcer, og hvordan etableringen af en bredbåndsinfrastruktur kan faciliteres.

De sekundære casestudier anvendte stakeholder analyse. Det fremgik af denne analyse, at lokale NGO'er og græsrodsbevægelser er relevante partnere for universal service funds. Et vigtigt resultat er, at en bæredygtig model fordrer en lokal interesse og et lokalt ansvar for infrastrukturen.

DEDICATION

Dedikeret til min mor, afdøde Mrs. Norah Williams (1952- 2010), med al min kærlighed. Det er sket. Dit endelige ønske gik i opfyldelse. Tak for alt ......

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Mange Tak

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ADC	-	Access Deficit Charge
ANT	-	Actor Network Theory
BLT	-	Build-lease-transfer
BOT	-	Build-Operate-Transfer
BOO	-	Build-Operate-Own
BOOT	-	Build-Own-Operate-Transfer
CAPEX	-	Capital Expenditure
CDMA	-	Code Division Multiple Access
CEE	-	Central and Eastern European
CIS	-	Confederation of Independent States
CPE	-	Customer Premise Equipment
CPUS	-	Central Processing Units
DBFO	-	Design - Build- Finance and - Operate
DBO	-	Design - Build - Operate
DBOO	-	Design-Build-Own-Operate
DSL	-	Digital Subscriber line
EU	-	European Union
FCC	-	Federal Communications Commission
FTTH	-	Fiber-To-The-Home
GIFEC	-	Ghana Investment Fund for Electronic Communication
GSM	-	Global System for Mobile Communications

GT	-	Grounded Theory
HI PPP	-	Health Informatics Public-Private Partnerships
HCSM	-	High Cost Support Mechanism
ICC	-	Interstate Commerce Commission
ICT	-	Information Communication Technologies
ICT4RD	-	ICT for Rural Development
IS	-	Information Science
IT	-	Information Technology
ITU	-	International Telecommunications Union
IP	-	Internet protocol
ISP	-	Internet Service Providers
JAWUG	-	Johannesburg Wireless User Group
KM	-	Kilometer
LMI	-	Last Mile Initiative
LOS	-	Line of Sight
MRIC	-	Magnolia Road Internet Coop
MMM	-	Municipality Mediated Model
NCA	-	National Communications Authority
NCC	-	National Communications Commission
NEPAD	-	New Partnership for African Development
NGO	-	Non-Governmental Organization
NGN	-	Next Generation Network
NTA	-	National Telecom Agency
NTC	-	National Telephone Company

OECD	-	Organization for Economic Co-operation and Development
OPEX	-	Operational Expenditure
OPP	-	Obligatory Passage Point
P&T	-	Post and Telecoms
PPHCP	-	Peak-to-Peak Healthy Community Project
POTS	-	Plain Old Telephony Service
PFI	-	Public finance Initiative
PPI	-	Public - Private Interplay
PPP	-	Public-Private Partnership
PPPP	-	Public-Private People Partnership
PIAAC	-	Program for the International Assessment of Adult Competencies
PUC	-	Public Utility Commissions
QOS	-	Quality of Service
RO	-	Renewable Obligations
RFID	-	Radio Frequency Identification
SGT	-	Societé Générale du Telephones
SPV	-	Special Purpose Vehicle
STS	-	Science, Technology and Society
SWOT	-	Strength Weaknesses Opportunity, Threats
TAM	-	Technology Acceptance Model
UA	-	Universal Access
UAS	-	Universal Access and Service

UK	-	United Kingdom
UN	-	United Nations
UNESCAP	-	United Nations Economic and Social Commission for Asia and -the Pacific
US	-	United States
US	-	Unified Service
US	-	Universal Service
USD	-	US Dollars
USPF	-	Universal Service Provision Fund
USO	-	Universal Service Obligation
USO	-	Uninterrupted Power Supply (UPS)
UTAT	-	US Telegraph and Telephone
VSAT	-	Very Small Aperture Terminal
Wi-Fi	-	Wireless Fidelity
WiMAX	-	Worldwide Interoperability for Microwave Access
WLAN	-	Wireless Local Area Network
WTO	-	World Trade Organization

CHAPTER 1. INTRODUCTION

1.0 INTRODUCTION

This is a multi-case study research. It is an analysis of bottom-up initiatives in developed and developing countries with the aim of facilitating either fixed or wireless Broadband infrastructure in rural areas. In this research, a search is conducted for possible relationships between the public and private sector that can aid the facilitation of bottom-up initiatives. This relationship, collaboration, cooperation or partnership is identified as Public Private Interplay (PPI) in this research. Public - Private Interplay is defined as contractual and non-contractual relationships between the public and private sector players aimed at facilitating telecommunication infrastructure (Gómez-Barroso & Feijóo, 2010). Examples of contractual relationships include Public-Private Partnerships (PPP) and Public Private People Partnerships (PPPP). Public - Private Partnerships generally denote a contractual agreement between the Public and Private sector where both sectors utilize their skills and assets to facilitate the development and management of an infrastructure or service (Cook J. , 2007). Public-Private People Partnerships is defined as the inclusion of people in PPP schemes (Ng, Wong, & Wong, 2013). The "people" here include civil societies as well. The process of liberalizing the telecommunications market is an example of non-contractual relationships between the public and private sector. In this case the collaboration towards telecom infrastructure development between the public and private sector is a loose one. The public sector provides governance, while the private sector owns and develop the infrastructure. These relationships are discussed in details in chapter 3 of this report. Based on this definition of PPI, the aim of the research can be rephrased as the search for possible PPIs that can facilitate bottom-up initiatives in rural areas.

In the process of conducting this research, the initial approach was to promote top – down approach to facilitating PPIs. However, this research is exploratory in nature. Hence, in the search for possible collaboration between the public and private sector (top-down approaches), the researcher was introduced to bottom-up models. The ability of people to facilitate – mostly - wireless Broadband infrastructure provided the inspiration for the shift in the focus of the research. The ability of that people to facilitate the network meant, that the public sector and the profit making private sector did not have to bear the cost of deployment and operations alone. The people could also bear the cost and also own the network. This provides the participating private sector entity a possible low rural Broadband infrastructure market entry and exit – if they are needed to help. The shift entailed moving away from possible top-down approaches towards facilitating Broadband Internet infrastructure using PPIs to how PPIs can be adopted to facilitate the bottom-up approaches. Hence, in the second literature review (Chapter 3), the discussion includes the use of PPIs to facilitate both top-down and bottom-up initiatives. However the outcome of the research produced a PPI/PPP model and the Municipality Mediated Model. The reason for calling it a PPI/PPP model and not a PPPP model is because the identified coops in the bottom-up approaches did metamorphose from a loose group of people to non-profit private sector business entity - making them a private-sector entity. Although they represent the people in some cases, their activities are commercial. Also, as mentioned in chapter 3, most coops (even the one studied) did metamorphose to become profit making private sector entities over time. Hence, from this explanation, civil society approaches can still be termed PPI/PPP. The fact on whether it should be termed PPI/PPP or PPPP is debatable. However, it was based on this fact that a discussion on the importance of PPP towards facilitating telecommunication and Broadband infrastructure was necessary in chapter 4. This is not to imply that PPPs are not PPIs hence warranting a separate chapter. Rather, it is the discussion on the different forms of PPP in chapter 4 that provided an inspiration on how the PPP/PPI model in chapter 11 (section 11.8) was developed with regards to infrastructure ownership, infrastructure management, infrastructure building, infrastructure, potential commercial and regulatory risks allocations. The caveat though, is that this report does not claim that every bottom-up approach are PPIs, but rather that some organizational and financial arrangements of some bottom-up approaches, as identified in this report, reflect some form of loose or strong collaboration between the public and private sector.

After the change in focus in the research, the new focus was to understand how these PPIs are organized and financed in the identified bottom-up initiatives. In cases where clear PPIs are not evident, the focus was to understand how the bottom-up initiatives came about, how they were financed and organized. These organizations and financial arrangements provided inspiration on how formulation of the PPI models in this report. The cases studied in the analysis were Broadband cooperatives, Non Governmental Organizations (NGO), Social enterprises and municipality initiatives from different parts of the globe representing developed and developing countries. The cases were: Magnolia Road Internet Coop (USA), Djurslandsnet (Denmark), Hallaryd Broadband Coop (Sweden), Johannesburg Wireless User Group (JAWUG) (South Africa), Dharamsala Wireless Network (owned by Airjaldi, India) and Wireless Ghana Project (Ghana). The case of Almhult Municipality Broadband Initiative (Sweden), was treated separately from the other cases. This was done to study how the public sector (municipalities) can stimulate bottom-up approaches to Broadband infrastructure development.

The aim of the analysis was to propose a PPI model/relationship or PPI models/relationships with possible plausibilities of facilitating Broadband Internet infrastructure in very poor rural areas of the world. Such areas exist mostly in developing countries and especially, sub-Saharan Africa. Hence, it was important to investigate into institutions that were already on the forefront of facilitating

Broadband Internet infrastructure in selected countries in sub-Saharan Africa. It was also important to understand their Broadband market stakeholder structure as managed by these institutions aimed at facilitating rural connectivity. Finally, it was important to know if there is room for facilitating bottom-up initiatives in these countries. The cases chosen for this second study were Ghana and Nigeria.

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The inspiration gathered from the analysis, coupled with the institutional arrangement from Ghana and Nigeria led to the development of the two plausible PPI models/relationships. The models are developed in a generic way, giving room for different jurisdictions to tweak the model as it fits into their context. However, the only aspect of the model that is constant is the fact that the infrastructure should be owned by the people.

The major contribution of this research is towards literature and with respect to identifying bottom-up models that can facilitate Broadband Internet infrastructure in rural areas. Public-Private Interplay (PPI) is a trending discussion on the analysis of Broadband and Next Generation Network (NGN) infrastructure (See (Nucciarelli, Sadowski, & Ruhle, 2014) (Feijoo, Gomez-Barroso, & Bohlin, 2011) (Kelly, Mulas, Raja, Qiang, & Williams, 2009)). PPI is a concept that denotes some form of interaction (direct/indirect) between the public and private sector in the facilitation of Broadband infrastructure development (see (Given, 2010)). An aspect of PPI often discussed with regards infrastructure development is Public-Private Partnership (PPP) (See (Yardley, 2012) (Nucciarellia, Sadowski, & Achard, 2010)). PPP, just like PPI does not have a universal definition. However, it implies a more specific relationship between the public and private sector aimed at facilitating a particular infrastructure. One may say that PPI is generic and PPP is specific. These concepts are often discussed at the macro level in the development of national Broadband infrastructure development (See (Kushida, 2013)). The essence of PPI in modern times has been to enable the public invest in the more expensive private sector high capacity Broadband and NGN infrastructure (Feijoo, Gomez-Barroso, & Bohlin, 2011).

Although not explicitly stated in literature PPIs have been implied to possess the potential of facilitating Universal Access and Service of Broadband and NGNs (See (Gillwald, 2015) (Nucciarelli, Sadowski, & Ruhle, 2014)). Universal Access in this report denotes the coverage of Broadband infrastructure in a geographical area. Universal Service denotes the level penetration of Broadband service within a population or at household level within a geographical area (See (Blackman & Srivastava, 2011)). However Gillwald (2015) advices that certain conditions have to be in place before PPIs could be effective. Such conditions include the success in the organization of past PPIs, relevant skill set by the government, non-rigid bureaucratic processes in managing new funding models, relevant institutional organization and a capable regulator (Gillwald, 2015)). Nucciarelli, Sadowski & Ruhle (2014) advice that investments “Public and non-Public parties” should be adopted as a tool for Universal Service Obligations (USO).

However, the contribution of this research to literature is not necessarily at the macro-level, although there are spill over implications, rather it is at the micro level. At the micro-level, there has been lots of research into bottom up-initiatives and how they operate (See examples (McMahon, et al., 2014) (Lindskog & Johansson, 2005) (Gaines, Morgan, Rukobo, & Saunders, 2014). There have been studies on why these cooperatives should exist (see example (Sadowski, 2014) (Hudson H. , 2014) (Gaines, Morgan, Rukobo, & Saunders, 2014)). In such cases the coops are seen both as Broadband providers and consumers. Studies have also been made to indicate that facilitating bottom-up initiatives can lead to the attainment of Universal Access and Service of Broadband Internet infrastructure and service (see (Hudson H. , 2014) (Fuentes-Bautista, 2014)).

However, at the micro- level of Broadband infrastructure facilitated by Broadband coops or NGOs there is very little explicit discussion on PPIs. But from the identified levels of collaborations between the public sector and private sector in the delivery of telecom infrastructure, one can identify PPIs in the discussions. In the third chapter of this report, an attempt to identify PPI’s, historically is made. However, few researches conducted in this area have identified the need for public assistance to the Broadband coops (see (Hudson H. , 2014)). There have also been studies calling for the facilitation of policies leading to municipality-community hybrid ownership that would enable and sustain these networks (see (Tapia, Powell, & Ortiz, 2009)). There has also been an argument for community ownership of coops facilitated via PPI (Kakekaspan, O'Donnell, Beaton, Walmark, & Gibson, 2014). There is also an argument for a blended top-down, bottom-up PPI facilitated by the public sector to facilitate Broadband coops (Salemink & Bosworth, 2014).

This research contributes to the discussion on the Broadband infrastructure delivery at the micro-level raised by Hudson (2014), Kakekaspan, O'Donnell, Beaton, Walmark, & Gibson, (2014) and Salemink & Bosworth, (2014). The results of this research point to people- owned Broadband infrastructure networks in agreement with Kakekaspan et al (2014). The results also point to the possibility Salemink & Borsworth (2014) combination of top-down and bottom up approaches. However, the difference between this research and their research borders on who should own the network. The results of this research also point to the fact that bottom-up approaches can complement the market based approach. This is because the market based approach will facilitate high capacity Broadband and the bottom–up approaches can bridge the True Access Gaps.

In the introductory chapter, section 1.1 provides a background to the problem and the possibilities identified for a solution. Section 1.2 explains the context and scope of the study. Section 1.3 identifies the specific question this research seeks to answer. Section 1.4 provides specific tasks or objectives that guided the research. Section 1.5 explains the significance of the findings of the research. Section 1.6 provides an overview of the work done in facilitating this research. Section 1.7 provides an overview of each chapter and how they relate to one another as well as to the research questions.

1.1 BACKGROUND OF THE RESEARCH

1.1.1 THE PROBLEM

The problem this report attempts to solve is that Broadband Internet infrastructure access gap is huge (ITU Facts and Figures, 2014). The general reason for this Broadband Access Gap is the fact that Network Operators and Internet Service Providers (ISPs) do not see rural areas as commercially viable (See (Williams, Rebecca, & Minges, 2011) (Williams & Falch, 2012)). Hence, the market forces alone is not sufficient to facilitate the extension of Broadband infrastructure into these non-commercially viable areas. In the 7th chapter of this report, research was carried out to verify the problem and document it. However, in order to investigate how this problem can be solved, the research focus was narrowed to developing countries and further down to sub-Saharan Africa. The reason for this choice was based on the fact that sub-Saharan Africa has the lowest level of penetration of Broadband Internet infrastructure – both fixed and mobile Broadband infrastructure- compared to other regions of the world (ITU (a), 2014). The implication of the problem is that Universal Access and Service (UAS) of Broadband Internet infrastructure may not be realized in rural areas in many countries. Hence, a solution is needed to enable rural connectivity, especially in areas where market forces alone cannot guarantee connectivity.

1.1.2 HOW THE PROBLEM IS ADDRESSED IN THIS RESEARCH

To solve the problem, an academic approach is adopted. So far – in recent times - approaches aimed at solving the Broadband infrastructure deficit problem has been a combination of top-down and bottom - up approaches (Yardley, 2012). The top-down approaches have been enhanced via various mechanisms aimed at facilitating the market. These approaches are discussed in the second chapter of this report. The bottom-up approaches have been enhanced either by private sector initiatives or by the people/individuals (See (Tapia, Powell, & Ortiz, 2009) (Hudson H. , 2014) (Yardley, 2012)). Research has proven that the bottom-up approach right from the days of telephone cooperatives till today's Broadband coops, etc. have been an effective way of extending telecom infrastructure into rural areas, where market facilitation failed ((Hudson H. , 2014) (Siochrú & Girard, 2005)). However, researches has been focused on identification of these bottom-up initiatives and their impact in the extension of Broadband infrastructure (see (Salemink & Bosworth, 2014) (Kakekaspan, O'Donnell, Beaton, Walmark, & Gibson, 2014)),

However, this research extends the on the research towards bottom-up approaches by investigating a way the bottom-up approach can be extended to meet the needs of very poor rural dwellers. The approach towards finding a solution to the problem - in this report - was to investigate how more bottom-up initiatives can be enhanced in various parts of the world – beginning from developing countries and sub-Saharan Africa. The possibility presented in this research is the proliferation of national fiber-optic backbone networks in sub-Saharan Africa. These backbones present Broadband gateway possibilities for rural areas.

Although these possibilities for bottom-up initiatives exist, the existential challenge of poverty faced by many rural areas, especially in developing countries and sub-Saharan Africa was not overlooked (see (World Bank, 2013)). The existence of poverty implies that one cannot expect these people in rural areas to facilitate Broadband Internet infrastructure when they have other priorities. However, recent studies indicate that people in rural areas are adopting Information and Communication Technologies (ICTs) – mostly mobile telephony- despite their poverty ((Gillwald, Milek, & Stork, 2010)). The "marriage" between radio broadcasting and social networks in sub-Saharan Africa and the availability of low bandwidth mobile internet in some rural areas has clearly presented the possibility of rural dwellers, in these parts, finding ICTs useful. As discussed in this report, cases were sighted where poor villages in Nigeria and Tanzania mobilized themselves to facilitate electricity and water supply provisions for their domains when they had the need for it. In this report, a case of community interest in facilitating wireless Broadband Internet infrastructure in Ghana is mentioned. Hence, the slow and growing need for ICTs in rural areas of developing countries and sub-Saharan Africa produces an opportunity. One would say that the demand for Broadband Internet services exist in rural areas, but it is dormant.

How do we wake up the dormant demand in the midst of poverty? This research was construed with the idea that the public interest and possible investment in facilitating bottom-up initiatives in rural areas, especially in developing countries and sub-Saharan Africa could wake up the dormant demand and propel rural dwellers to lead the way in facilitating supply. The overall implication of this act is that the Broadband Access gaps can be closed up over time leading to the Universal Service of Broadband Internet infrastructure in any country, most especially developing countries and sub-Saharan Africa.

1.2 CONTEXT , SCOPE OF STUDY

This research focuses more on the supply side of the market. The assumption is that demand is latent, waiting for supply. This is a two multi-case study research. The first multi-case study is the primary case-study and the second multi-case study is the secondary case study. The overarching context of the primary case study was that the cases should be bottom-up initiatives. The contexts were; the cases had to be people or municipality led initiatives and it had to be situated in a rural or semi-rural area.

The contexts of the secondary case were that the universality funds in both Nigeria and Ghana, hence institutional contexts. However, the overarching context is that the institutions are located in sub-Saharan Africa, where Broadband Internet penetration is low. The scope of both case studies is discussed in the next section.

1.2.1 SCOPE OF THE PRIMARY CASE STUDY

The aim of the primary case study was to study existing rural/semi-rural bottom up approaches around the world- from developed and developing countries - to understand how the people mobilized themselves to facilitate the Broadband infrastructure. The second aim was to search for Public-Private Interplay in the processes. These aims provided boundaries for the research and defined the scope of inquiry. The essence of this investigation was to gain inspiration towards the design of PPI models for the secondary cases. The primary cases were:

Developed Country Cases: Magnolia Road Internet Coop (USA), Djurslandsnet (Denmark), Hallaryd Broadband Coop (Sweden) and Almhult Municipality Broadband Initiative (Sweden). However, the Almhult Municipality Broadband Initiative –though a developed country case- is treated separately in the report. This is because it is a public led initiative. They facilitate the hybrid approach (top-down, bottom-up) towards Broadband infrastructure delivery. To create a distinction between this other developed country case and the hybrid approach, it is referred to in the Grounded Theory Analysis as the public sector case. The significance of this case to the report is that it provides inspiration on how the public sector can facilitate bottom-up approaches. Although the Hallaryd coop came into existence as a result of the municipality’s inspiration, It is treated separately because the people of Hallaryd did mobilize themselves and deployed their infrastructure with help from the municipality.

Developing Country Cases: Johannesburg Wireless User Group (JAWUG) (South Africa), Dharamsala Wireless Network (Owned by Airjaldi in India) and Wireless Ghana Project (Ghana).

1.2.2 SCOPE OF THE SECONDARY CASE STUDY

In the previous section, sub-Saharan Africa was identified as the region in the world with the lowest penetration of Broadband internet infrastructure. Hence two sub-Saharan African countries, Ghana and Nigeria, were identified as countries with vast fiber-optical backbone networks and lots of rural areas as well. Both countries also own very active universality funds who are involved in facilitating rural wireless Broadband connectivity. Hence, the findings of this research could be of use to them and similar agencies globally, whose responsibility is to facilitate rural wireless connectivity. The universality funds in both countries serve as the secondary case of the research.

1.3 RESEARCH QUESTION

The research questions were developed primarily to identify PPI models that can cater for any rural area, including the poorest of the poor in rural areas. An area where the poorest of the poor rural areas exist can be identified in sub-Saharan Africa and Asia (World Bank, 2015). However, the cases from in South Asia such as the Philippines, did not respond when contacted, hence contact was restricted to the sub-Saharan African cases.

Although this report is not about Ghana and Nigeria, the argument here is; if the models identified could serve the poorest of the poor, then it can also serve rural areas that not so poor, hence leading to the potential of the models becoming universal models. The research questions were as follows:

Main Research Question: What type of Public Private Interplay will enable the development of Broadband Internet Service in rural areas of developing countries?

Sub-Research Questions:

- What forms of PPI/PPPs exist in Nigeria and Ghana?
- What external inspirational bottom up-PPI initiatives that exist?
- How are these bottom-up initiatives organized and financed?
- How can these PPIs initiatives be applicable to Ghana and Nigeria?
- How can these applied PPIs be organized?

- What are the funding implications for such applied PPIs?

1.4 OBJECTIVE OF THE RESEARCH

In the bid to answer the research questions, the following objectives were outlined in the research:

- The first objective of the research is to find out what PPI initiatives exist in Ghana and Nigeria.
- The second objective of this research is to find out the impact of these PPIs to the development of Broadband internet in Nigeria and Ghana.
- The third objective of this research is to find out if there are innovative PPI initiatives available elsewhere that could fill the Broadband Internet gap in Ghana and Nigeria.
- The fourth objective is to find out how the new PPIs are organized and what are the driving forces behind the organization.
- The fifth objective is to find out how the PPIs are financed.
- The sixth objective is to find out how the lessons learnt from the secondary cases could supplement the efforts in Ghana and Nigeria.
- The seventh objective is to understand how the identified initiative affects efforts toward attaining Universal Access and Service.
- The eighth and last objective is to find out if these applications of the Actor Network Theory (ANT), the Grounded Theory (GT) and Stakeholder Theory affected the description of the cases and what does this imply to the theories.

1.5 SIGNIFICANCE OF RESEARCH

Why is this research important? The importance of this research can be viewed in three ways. Some of the ways include:

The practical point of view: This research addresses the possibility of solving a practical problem. The problem of low penetration of Broadband infrastructure in rural areas. The PPI/PPP model and the Municipality Mediated Model proposed in this report can be relevant to national governments, International donor agencies, consultants and other players involved in facilitating the Universal Access and Service of Broadband infrastructure in their various countries or country of interest. The Broadband infrastructure implementation models are relevant to rural dwellers who are interested in facilitating either fixed or wireless (preferred) Broadband infrastructure development in their respective domains.

The contribution to the literature: This finding of this research is a contribution to the literature on Universal Access and Service and PPIs. The findings of the research points to the possibility PPIs has the potential of enabling the Universal Access of Broadband Internet infrastructure. This research does not really contribute to literature on PPP. This is because the PPP discussion of the PPI models are on a broad-level and not at the micro-level where the fine details of the PPP framework is tackled.

Theoretical significance: This research provides a contribution to the diffusion of innovation theories as mentioned earlier. The PPI/PPP models and the Municipality Mediated Model are not theoretical proposals, but a framework for working relationships. However, these working relationships can be theorized in future researches.

1.6 OVERVIEW OF THE WORK DONE

In this section, a summary of the work done in this research is explained. The summary includes, the conception of the research idea (the initial idea and the more concrete idea), the methodology adopted in the research, the theoretical approach adopted in the research and the overview of the findings in the research.

1.6.1 INITIAL IDEA

The initial aim of this study was to study how Public Private Partnerships (PPP) would aid in the development of Broadband Internet infrastructure in rural areas. This was meant to be an action research from the top-to-bottom perspective. The researcher was to be situated within the universality funds in Ghana to follow a Broadband implementation process between the public and private sector developing Wireless Broadband network using Wi-Fi. The process was to be facilitated by the researcher. The researcher did conduct a preliminary research with Broadband infrastructure developers From Zimbabwe, Ethiopia and Kenya to understand the technical solution that would be feasible. However, this PPP process did not come to fruition due to the inability of the researcher to get the private sector involved. At the start of the process, 80 questionnaires were sent out to the private sector (Internet Service Providers) and there were only three responses. However, the responses were mixed with and negative feelings towards facilitating wireless Broadband infrastructure development in rural Ghana. The positive feeling arose from the fact that, the private sector would be willing to partner with the private sector if the public sector would finance the process. However, this was without a caveat, which leads to the negative feeling. They had to be sure of the demand and how the hidden cost would be handled. They also were not keen on partnering with another ISP in an area where the return on investment was not guaranteed. There was no problem with the public sector Ghana

Investment Fund for Electronic Communications (GIFEC). In the questionnaire, the public sector was willing to undertake a PPP initiative. However, the snag from the private sector end, coupled with limited funding led to the suspension of this angle towards the research.

1.6.2 MORE CONCRETE IDEA

The snag in the first approach led to the shift in approach towards the research. The implications of the snag implied that an alternative form of Broadband infrastructure development rather than the market-based approach or top-down PPP approach was necessary to facilitate rural Broadband infrastructure in rural areas. The new approach sought for was inspired by bottom-up approaches in literature (See (Stern & Townsend, 2006) (Yardley, 2012)). Stern & Townsend (2006), identified bottom-up initiatives in South America, while Yardley (2012), identified bottom-up initiatives in Europe. The bottom-up approach provided an opportunity to investigate a new sense of infrastructure development and ownership. People - owned infrastructure in sub-Saharan Africa, where Ghana and Nigeria would be the countries where the case would be situated. Attempts were made to reach out to the identified South American cases identified in Stern & Townsend (2006). This is because they were situated in developing countries. The idea was to learn about these bottom-up initiatives and identify how PPP/PPIs can be developed to facilitate these initiatives in Ghana and Nigeria.

However, simultaneously, a more concrete idea of how to facilitate some private sector involvement came with a chance meeting with Dr. Wolter Lemstra from Delft University. They (Wolter and Vic Hayes) were interested in writing a book about the History of Wi-Fi and they needed a researcher to find out how the DjurslandsNet Wi-Fi Project fared. This invitation provided an opportunity to inspect up-close, a bottom-up initiative in Denmark. The team took a visit to Djursland and here an inspiration was unearthed. This inspiration was the facilitation of a bottom-up approach via Community Based Broadband Networks. This inspiration led to the research on possible similar initiatives in sub-Saharan Africa and how it can be implemented in a better way in Ghana and Nigeria for a start. The initial online search led to Macha works in Zambia and later to the Serengeti Broadband network in Tanzania (See (Nungu, Brown, & Pehrson, 2011)). However, there was no sufficient information about these cases. The attempt to contact Macha Works did hit a dead end while a brief exchange of emails with Dr. Nungu indicated that the Serengeti Network was not very active but not dead. However, a case that was easy to access was the Wireless Ghana Project, located in the Eastern region. An interview was conducted by an anonymous source, who preferred to be anonymous if, the person was to provide a clear information on why the viable project ceased to exist. Hence, in respect of the person’s privacy mention is not made of the name of the reliable source. This case is described in this report and the lessons from this case are adopted in the analysis of this report. As luck would have it, Vic Hayes, from Delft University provided a link to John Kibuuka from Uganda. He, John had experience setting up ICTs in rural Uganda and Tanzania; hence his input was valuable as well. His inputs are reflected in this report.

Having learned the little that could be learned from the cases in sub-Sahara Africa, it was important to identify at least one rural Community-Based Broadband network in each continent of the world and interview them. The reasons for such a selection were:

- To understand the trend of Community Based Network globally with respect to understanding their similarities and differences.
- To study more variety of bottom approaches to understand if the cultural, societal or economic features in all the cases were uniform or dissimilar.
- To gain an inspiration that could produce an overarching PPI framework based on the similar features that run through each of the cases.

It was important to understand how they came about and how they are financed. However, the most important aspect of these interviews was to identify the role PPI/PPP played in facilitating these networks. The Magnolia Road Internet Coop (USA), DjurslandsNet (Denmark), Alhmult Municipality Broadband Network (Sweden), Johannesburg Wireless User Group (South Africa), Dharamsala Wireless Network and (Owned by Airjaldi in India). Unfortunately, there was no response from the South American groups. These coops served as the primary cases for the research. The number of cases would have been larger. However, most of the cases contacted did not respond. There was also the challenge of a language barrier with some South American cases. The empirical material gathered from the cases was in the form if interviews with key persons in the organization. This limited the number of respondents per case. However, some of the cases provided supplementary materials while others had comprehensive information on their websites to supplement the empirical material. The effort was also made to gather secondary literature to gain secondhand perspectives on the cases. These data sources were utilized in the Grounded Theory process and Stakeholder Analysis process. When coding for the Grounded Theory process, it was evident that there were duplicate information and data from the various sources. Hence, the interviews were used as the accepted codes. This is why the empirical materials seem few. However, lessons from the aforementioned cases in addition to what was learned about Wireless Ghana could help to understand the factors that would facilitate the formation of such bottom-up initiatives in Ghana and Nigeria and later sub-Saharan Africa. More on the rationale for choosing the secondary cases can be found in chapters 8 and 9 of this report.

The outcome of the research process led to the division of the research into two case studies. The first case study – the primary case study - is the study of the individual rural bottom-up initiatives in each country identified. The second case study- the secondary case study- is the study of the universality funds in Nigeria and Ghana to understand how they are using PPP/PPIs at the moment to facilitate Broadband infrastructure. The second aim of the secondary case study was to find out if the bottom-up initiative will be of interest to them.

1.6.3 OVERVIEW OF METHOD AND THEORETICAL APPROACH

This research is situated in the interdisciplinary field of Information Science. Information science involves the analysis, collection, classification, manipulation, storage, retrieval, movement, and dissemination of information (Stock & Sock, 2013). This description is a broad category which may intersect with Information Technology (IT) and Information Systems (IS) and the social sciences. The Broadband Internet Networks can be studied under fields of IT, IS and the Social Sciences. However, the aspect of Information Science that led to the situation of the research in the field is in the social sciences. The interdisciplinary of the research in the social sciences field cuts across sociology, economics, telecoms law (regulation) etc.. To facilitate the interdisciplinary nature of the research, the Science, Technology and Society (STS), a sub-field in social science is adopted for this research.

Overall, this is a pure qualitative research. The research approach is a mixture of an exploratory research and the multi-case study research. The epistemological and ontological stands of this report are Interpretivism and constructivism respectively. The constructivist world view was adopted to construct knowledge out of the phenomena investigated.

In the primary case-studies, the research approach was a mutually exclusive simultaneous combination of inductive and deductive research strategy for the primary case study. The Actor Network Theory (ANT) is used as the theoretical approach for the deductive part of the primary case study. This theory is used to understand how the primary cases are organized and financed.. It is from the ANT that the inspiration for the potential actors for the PPI/PPP model and the Municipality models are derived. Although, one would say that the emerging models represents a black box of potential actors, one would say that the black box exists to grant different jurisdictions the leeway to identify the relevant actors. However, in this report, the actors identified via the ANT provides an insight to whom such actors could be. There were limitations in applying the Actor Network Theory, as the outcomes were highly descriptive and vague. It stood the risk of the researcher’s bias. In order to reduce the bias and validate the Actor Network Findings, the Grounded Theory approach was used simultaneously. The Grounded Theory approach was used an analytical tool to generate hypothetical models from the qualitative data generated. The outcome of the Grounded Theory produced the implementation models that led the social actors (people) in the various Bottom-up initiatives to galvanize resources to facilitate Broadband Internet infrastructure. Three models are developed here. They are the developed country models, the developing country models and the municipality initiated model.

In the secondary case studies, the research approach was purely deductive. The analytical tool was the Stakeholder Theory framework by Mitchell, Agle & Wood (1997). Their approach was adopted because they had a clear framework of understanding which stakeholder was either, dominant, dormant or demanding (See (Mitchell, Agle, & Wood, 1997)). This model led to the understanding of the dominant stakeholders, dormant and demanding stakeholders in the Universal Access and Service ecosystems in Ghana and Nigeria. Having an understanding of these dimensions of stakeholders provided an insight into stakeholders that are permitted by law to collaborate with the Universality funds in Ghana and Nigeria.

The exploratory aspect of this research permitted the gathering of data from government portals on PPP/PPI in Ghana and Nigeria to understand the national culture of the countries towards PPIs/PPP. It also enabled the literature review of this report be approached from an exploratory point of view.

1.6.4 OVERVIEW OF FINDINGS

Overview of the findings of the Primary Case study: The overall findings from the primary case study were an affirmation that rural dwellers had the ability to facilitate Broadband Internet networks. In the developing countries, the rural dwellers facilitated wireless Broadband networks using Wi-Fi. In the developed countries, the rural dwellers facilitated both fixed and wireless Broadband Internet networks. The common thread that was prominent in all the cases was the fact that they all sought for both public financial and regulatory aid. In cases where the financial help did not materialize, the people organized themselves. Finally, most cases were PPIs and few PPPs. The primary cases provided inspiration for how bottom-up initiatives can be organized and financed.

Overview of the findings of the Secondary Case study: The Nigerian government had active PPPs aimed at facilitating Wireless Broadband Infrastructure in the country. The universality funds in Ghana and Nigeria, both adopt PPPs in facilitating Broadband infrastructure. There was evidence that there was a fiber - optic gateway to many rural areas, presenting an opportunity for localized wireless or fixed Broadband networks (Wireless Wi-Fi networks recommended). Data gathered from the universality funds indicates that the universality funds in Ghana and Nigeria are open to facilitating bottom-up initiatives.

Overall overview of findings from the report: The summary of the overall findings is that people-owned Broadband networks can be facilitated using PPIs/PPPs. Based on inspiration from the primary cases, the Broadband implementation models provide inspiration for mobilizing local people in rural areas of developed and developing countries to facilitate Broadband Internet infrastructure. The PPI/PPP model provides a framework for a Public-Private partnership facilitating people owned networks. The Municipality Mediated Model provides a framework for very poor rural areas. Here the Municipality facilitates the people owned networks. The implication of the findings to Ghana and Nigeria is that the facilitation of Broadband Internet infrastructure is possible using the proposed frameworks.

1.7 ORGANIZATION OF FINDINGS

Chapter1: This chapter introduces this report, the problem to be solved, question this report aims to answer, the scope of the report, the significance of the report and an overview of the work done.

Chapter2: This is a literature review discussing the concept of Universal Access and Service. The discussion includes how the concept is defined, the evolution of the concept, the rationale of the concept and how the concept is facilitated.

Chapter3: This is a literature review discussing the concept of Public Private Interplay. The discussion borders around the concept of an interplay, what relationships denote PPIs, How PPIs facilitate ICT Infrastructure development and why the identified relationships between the public and private sectors are called PPIs. This chapter connects PPIs to Universal Service delivery as well as identified PPPs as a form of PPI. It connects chapters 2 and 4.

Chapter4: This is a literature review discussing the concept of Public Private Partnerships. The discussion borders around the understanding of the concept of PPPs from literature and from its historical evolution. The discussion also extends to identifying the forms of PPP and how it has been used to facilitate telecom infrastructure delivery in general.

Chapter5: This chapter is a literature review about the theories and analytical approaches adopted in the bid to perform this research. In this chapter, the field where this research is situated and the emerging theories from the field used in this research is discussed. The final part of the chapter provides an explanation on how the theoretical triangulation was deployed in this research and why that had to be done.

Chapter6: This chapter describes the research design for this research. This chapter is a combination of literature and personal reflections on the research philosophy, the research approach and strategies. The personal reflection is highlighted as to help the reader understand the practical implications of the research philosophy, approach and strategies to this particular research.

Chapter7: This is the first findings chapter. As this research is exploratory, an attempt was made to investigate the problem of low Broadband connectivity. The findings represented in this chapter are findings from field observations, literature and mobile network signal maps (recommended from a Mobile network Operator in Ghana). If these findings were not in line with the literature, the research would have changed course.

Chapter8: This is the second chapter in the findings section. However, this is the first chapter with an analysis of the findings. The Actor Network Theory is used to identify how the primary cases are financed and organized. These findings provided answers to sub-questions 3 of the research questions and a partial answer to research question 4.

Chapter9: This is the third chapter in the findings section. However, it is the second chapter with an analysis of the findings. Here, Grounded Theory is used to validate the ANT findings to see if they correlate with respect to how the primary-case organizations were formed. By extension, two models emerged in the process, indicating the causalities that led to the implementation of Broadband Internet infrastructure in the developing country cases as well as the developed country cases of the primary-cases. These models provided an insight on how rural dwellers in developed and developing countries can be mobilized to facilitate Broadband Internet infrastructure. It provided a partial answer to research, question 4. This is because people have to be mobilized before an organization or financial arrangements are made.

Chapter10: This is the fourth chapter in the findings section. It is the third chapter with an analysis of the findings. However, it is the first and only findings of the second multi-case study. The results on the identified PPIs aimed at facilitating Broadband infrastructure development are mentioned in this chapter. The Stakeholder Theory was used to investigate the universality fund ecosystem of the secondary cases to identify which stakeholders are definitive (stakeholders with dominant powers), Expectant (stakeholders that are legitimate and possess powers) and latent stakeholders (dormant, demanding and discretionary stakeholders). Understanding who these stakeholders were and what their current role was in the Universal Service ecosystem in Ghana and Nigeria, provided an insight on the role distribution of stakeholders in the PPI model.

Chapter11: The chapter is a synthesis of findings from the primary multi-case study and the secondary multi-case study. This chapter presents the summary of the findings as well as showcases the PPI Model as well as the Municipality Mediated

Model facilitated by the synthesis. The bias in this chapter is that the frameworks are tilted more towards very poor rural areas. However the model as mentioned earlier has global implications.

Chapter 12: In this chapter the findings are discussed in the summary. The discussion portrayed the contribution of the findings to the literature. It provided room for theoretical reflection as well as the implication of the proposed models to practice. In this chapter, the limitations of the research are discussed as well.

Chapter 13: This is the concluding chapter of the report where the contributions of the report are highlighted and possibilities for future work mentioned.

LITERATURE REVIEW SECTION

Literature review section 1 consists of chapters 2, 3 and 4. These sections consist of literature on the core content of the research.

Literature review section 2 consist of of chapter 5. This is the theoretical approach chapter of this report. Here the how the overview of the theories and how they are used in the report are explained.

CHAPTER 2. UNIVERSAL ACCESS AND SERVICE INITIATIVES

2.0 INTRODUCTION

Universal Access and Universal Service are concepts that transcends telecommunications and ICTs. It is a concept used in the health sector, housing sector, education sector and in the provision of infrastructure for utilities such as water supply and electricity (See (WHO, 2009) (Vun, et al., 2014) (Tiwari & Hingorani, 2014) (Dusen & Greald, 2014) (Bain, Wright, Christenson, & Bartram, 2014) (Daniel & Arsh, 2014) (Tully, 2006) (Sobsey, 2002) (Mace, Hardie, & Plaice, 1991)) . In these sectors of the economy, Universal Access denotes universal coverage of the service provided by the sector or in the case of infrastructure delivery, the universal coverage or availability of the infrastructure. Universal Service denotes the availability of the service for all.

Universal Access (UA) and Universal Service (US) of ICTs are concepts often used to denote the level of availability and the usage of ICT networks and services respectively. These concepts are in some cases used interchangeably and in other cases referred to in one phrase or word, "*Universal Access and Service*" or "*universality*" (Xavier, 2008) (Liu & Wu, 2013) (Lewis, 2013).

The usage of these terminologies has evolved over the years. This is because the public and private sector in different countries, independently adopted Universal Access and Universal Service policies to facilitate specific telecom infrastructure diffusion and specific telecom service adoption. This fact is explained in details in section 2.2 of this chapter. The evolution of the Universal Access and Universal Service policies, from the public sector point of view, has been influenced by the type of services identified as basic services or public goods as provided by a telecommunication network (Xavier, 1997). In the bid to ensure Universal Access of the telecom network infrastructure in question, Universal Service Obligations (USO) are handed out to incumbent telecom network operators. Based on these factors, the concepts of Universal Access and Universal Service continuously evolve and in some cases used interchangeably.

Although the policy concepts of Universal Access and Universal Service are used interchangeably, they are distinct concepts. In this chapter, the concepts are also used in a distinct manner. Although, there are cases where the concept of Universal Access and Service - in this chapter - is used to denote the attempt to attain both policy concepts. This is evident in section 2.2, where the words Universal Access and Service is used. The reason for this is because the view toward Universal

Service in some cases had Universal Access component in it. An example is the case of AT&T's early usage of the term Universal Service as motioned in section 2.2. The second reason is because the mode of adoption or delivery of the end user differed. In the days the Electric Telegraph, rarely was telegraphs terminated at homes. They were terminated mostly at train stations. Hence the concept of Universal Access then was different from today. In the delivery of Broadband and Next Generation Networks, multiple services are terminated via fiber optics or a wireless Broadband delivery to the homes. Here individuals have "*access*" to multiple services. Hence there is a debate on what should be termed Universal Access in Universal Service Obligations (Xavier, 2008)

In this report, the distinction of between Universal Access and Universal Service is that Universal Access of Broadband Internet connectivity denotes Broadband infrastructure coverage and Universal Service of Broadband Internet connectivity denotes Broadband service penetration. In this chapter, the usage of the Universal Service and Universal Access varies. This is because, an attempt is made to understand how the concept has been used over time.

In this chapter, the following literature was reviewed to find answers to the following questions:

- What is Universal Access and Universal Service?
- Why is Universal Access and Service important?
- How is universal Access and Service facilitated?

The answers to these questions will be discussed from a historical point of view – using academic literature- in section 2.2 and from a purely academic literature in sections 2.1, 2.3, 2.4 and 2.5. The reason for adopting this approach is to identify how Universal Access and Universal Service polices evolved and was viewed over time. This approach provides an insight into both institutional and non-institutional approaches to the concept over time.

The significance of this historical overview transcends this chapter into chapter 3 and chapter 4. This is because the central theme of the literature review section (Chapters 2, 3 and 4) is that PPIs have the potential of facilitating Universal Access and Universal Service. The review of literature on PPIs in chapter 3 and PPP in chapter 4 was designed to discuss how these New Public Management concepts (PPP/PPI) have evolved in certain countries from when the electronic telegraph was adopted till modern times. Hence, if one juxtapose the three chapters, one would see that PPIs were evident in the effort to develop telecom infrastructure over time. Hence, this report posits that more innovative PPI arrangements could further enhance Broadband infrastructure delivery, leading to possible Universal Access and Universal Service of Broadband Internet infrastructure and service.

This chapter is divided into 5 sections.

Section 2.1: This section provides and overview of the concept of Universal Access and Universal service. This section provides an answer to "*what is Universal Access?*"

Section 2.2: This section provides the historical overview of UAS as it evolved in the United States and selected European countries. The selected European countries were selected based on the accessibility to literature discussing the Evolution of telecom network development in these countries. This section provides an answer to why Universal Access and Universal Service policies are important. The section also provides an answer to "*What is Universal Access and Service?*", from the historical point of view.

Section 2.3: This section describes the rationale for Universal Service Obligations from literature. This section provides answers to why Universal Access and Universal Service policies are important.

Section 2.4: This section provides a discussion on mechanisms for facilitating Universal Access and Service mechanisms. This section provides answers to how Universal Access and Universal Service is facilitated.

Section 2.5: This is the conclusion of this chapter.

2.1 OVERVIEW OF UNIVERSAL ACCESS AND UNIVERSAL SERVICE

Universal Access and Universal Service are forms of telecom regulatory policies aimed at promoting the access provision of telecom services and the actual usage of the telecommunication services respectively by facilitating the interconnection of parallel networks (See (Intven, Oliver, & Sepulveda, 2000) (Blackman & Srivastava, 2011)). These policies are normally driven towards the facilitation of the diffusion and adoption of specific telecommunication services identified as basic services. To ensure that these basic services are accessible to all and used by all, regulatory obligations aimed at facilitating Universal Access and Service are often applied to the incumbent operator(s). These regulatory instruments are referred to as Universal Service Obligations ((Intven, Oliver, & Sepulveda, 2000)).

In this section, the discussion centers on how Universal Access and Universal Service are defined - based on the acceptable basic services. When the Plain Old Telephony Service (POTS) was prevalent, the basic service was voice calls.

However, today with the growth of Broadband and the numerous services, there is a debate on what should be the basic service. This challenge has affected how the Universal Access and Universal Service policies for Broadband infrastructure and services are defined. The final section of this chapter, presents an overview of how academics see the future of Universal Access and Universal Service policies.

Before proceeding in this chapter, it is important to note that the definition of Universal Access is usually related to the policy goals of the country(ies) in question as seen in table 2.1 below. Universal Service policies are defined in Universal Service Obligations (USO) mandated to incumbent telecom companies in different countries by the public sector. They were also defined in National ICT policy documents. The reason for the difference in UAS policies in different countries is as a result of the political, cultural and economic conditions of the country seeking the UAS of any ICT technology (Bhuiyan, 2004). As a result of this fact, Universal Access and Universal Service policy definitions for different countries differ. The difference can also be seen between the developed and developing country approach towards the concept of Universal Access and Universal Service.

Table 2- 1Definition of Universal Access in some selected Developing countries

Country	Definition
Costa Rica	Universal Access is defined as the availability of a telephone within 1km of a person's home or workplace
Burkina Faso	Universal Access is defined as the availability of a telephone booth within 20km
Colombia	Universal access is defined as the provision of a telephone in every urban household and communal phone in sub-urban or rural areas
Morocco	Defines Universal Access as providing an access point for every community

Source (Williams, Gyaase, & Falch, Enhancing rural connectivity through an extended internet cafés business models, 2012)

In previous years, when voice calls were regarded as a basic service transmitted via POTS networks, the difference in the approach towards defining Universal Access and Service was clear along the lines of developed and developing country contexts. This is because, in the developing countries, these countries were interested in providing access to public telephones in rural areas and areas that were not commercially feasible (Benjamin & Dahms, 1999) (Bhuiyan, 2004). Developing countries were also saddled with under-funding towards network expansion (Hills, 1989). Hence Universal Access policies were developed to cater for the expansion of incumbent national telecommunication infrastructure in the country. In the developed countries, the concept of Universal Access and Universal Service involved possessing adequate infrastructure that will provide a telephone line to every home and business (Wellenius & Stern, 1994). The Universal Service Obligations (USO) in this period were included in telecom licenses mandating the provision of Universal Service of Plain Old Telephony Service (POTS) to every citizen within a specific period of time and with certain Quality of Service parameters.

Today, in the development of Broadband infrastructure, this clear line still exists. In most developing countries, the Universal Access policies are aimed at solving the problem of Broadband infrastructure deficiency (Gillwald & Calandro, 2014). Universal Service Obligations are currently provided in 3G and 4G mobile licenses to incumbents and new entrants as mentioned in chapter 7 of this report. In the developed countries, Universal Service Obligations are aimed at delivering upgraded high speed Broadband service and applications to every home. Universal Access Policies are aimed at facilitating fixed and mobile Broadband infrastructure to every home.

Although these dichotomies exist, definitions of Universal Access and Universal Service from academic literature as viewed during the former prevalent POTS and current Broadband Service exists.

UNIVERSAL ACCESS AND UNIVERSAL SERVICE OF THE POTS

In literature, there are acceptable definitions of Universal Access and Universal Service. These definitions identified voice calls as a basic service when POTS networks were prevalent. Universal Access and Universal Service were defined as:

Universal Access: The provision of reasonable means of access to a publicly available telephone (Intven, Oliver, & Sepulveda, 2000). Intven, Oliver & Sepulveda (2000), identified the provision of pay telephone, telecentres, tele-boutiques and community Internet centers as ways by which telephony provision was facilitated in areas, where household connectivity was not commercially viable. As mentioned earlier, this was a more practical objective for developing countries due to infrastructure deficit.

Universal Service: The availability of household connectivity to telephony in the whole country (Intven, Oliver, & Sepulveda, 2000). The objective of ensuring Universal Service is regarded by Intven, Oliver & Sepulveda and Universal Service Obligation. As mentioned earlier, this was more practical in developed countries, where there was access to telephony, what was left was household adoption of the service.

Examples of other specific definitions are expressed in box 2.1 below. These definitions do not differ with regards to the context of infrastructure coverage and service penetration to the aforementioned definition. Rather, they differ in approach towards the magnitude of coverage and penetration. They also differ with respect to distinct or merged policy definitions as seen in the table 2.1 below.

However, within the period when the Plain Old Telephony Service (POTS) networks were the prevalent till date, Universal Access and Universal Service have been hinged on the affordability, availability and the Accessibility of the infrastructure to every citizen (Alampay, 2006) (Blackman & Srivastava, 2011). However, these three hallmarks serve as drivers for the diffusion and the adoption of the basic service(s) enabled by the ideas of social inclusion.

Box 2- 1 Universal Access Definitions with Fixed-Line Telephony as Technology of Choice

Affiliation: Infodev/Worldbank/ITU

Universal Access: This implies ICT services considered by the public sector for social inclusion and economic development are available, affordable and can be accessed by every citizen.
Universal Service: This implies that every citizen or household within a geographical location can afford, have subscribed (access) to this essential ICT services

Source (Oestmann & Dymond, 2008)

Affilitation: OECD document

The OECD in 1991 identified three approaches towards Universal Service.

- The first approach entailed the access to telecommunication services by every citizen,
- The second approach entailed Access to telecommunications as an economic good to be consumed by all without discrimination
- The final approach entails the access to telecommunication networks based on the potential network externality provided by the telecom network

Source (Organization for Economic Co-operation and Development), 1991)*

Affiliation: ITU document

Universal Service: This implies telephone in every home underpinned by policies to make the Service affordable..
Universal Service: This implies that the public telephone should be within distance to everyone.

Source (Williams, Gyaase, & Falch, Enhancing rural connectivity through an extended internet cafés business models, 2012)

Example from some Academic document

Universal Service implies the provision of telecommunications services at a household level, while Universal Access implies the guaranteed access to telecom infrastructure, which may occur on a shared basis as well

Source (Xavier, 2008)

“..the obligation of an operator to provide all users with a range of basic services of good quality at affordable prices”

Source (Cremer, Gasmi, Grimaud, & Jackson, 2001)

*The focal technology that led to this line of thought was the fixed-line telephony.

UNIVERSAL ACCESS AND UNIVERSAL SERVICE OF BROADBAND AND NGNS

As mentioned early in this chapter, voice calls are still regarded as a basic service, but that is changing. This is because, at the dawn of the privatization of national monopolies and the liberalization of the telecommunications markets, new telecom network such as digital mobile telephony, Broadband Internet networks and today's NGNs, were introduced into national telecom markets. These acts changed the telecommunications landscape (Xavier, 2008). Broadband and NGN networks are recent networks to be adopted into the national Broadband market. They are networks that enable the convergence of Broadcast, telecommunications and electronic communication networks (Blackman & Srivastava, 2011) (Blackman R. , 1998). According to Blackman (1998), these technological outcomes had an effect on regulations as well. This is because previous sector specific regulations are evolving into the sectoral convergence of broadcasting, electronic communications and telecommunications sector in some countries such as South Korea, Ghana and a lot of other countries (Yoo & Lee, 2014) (Williams & Kwofie, 2014). The converged network infrastructure deployed on telecom platforms opened up the possibility of multiple broadcasts, electronic communication and telecom services being delivered via telecoms networks with greater bandwidth to deliver video, audio and voice transmissions (Nucciarelli, Sadowski, & Ruhle, 2014) (Hudson H. , 1994). The emergence of converged networks enables the delivery of multiple services via the Internet such as Ring back tones, Location Based Services (LBS), online gaming and live streaming, etc.. Hence, there is dilemma on which service is considered, basic (to be promoted under the USO) and which service is considered a luxury (Blackman & Srivastava, 2011)? This is the implication of technology evolution from the POTS to digital telecom networks (Fixed and Mobile).

This result of the aforementioned relationship triangle portrays the link between policy (UAS policy), technology (telecom/Broadband networks) and the market. This triangular relationship in the delivery of Broadband on converged networks, as identified in the previous paragraph, raise issues towards what service should be promoted for Universal Access to Broadband networks and Universal Service for Broadband networks as a result of the potential to deliver multiple services to different households with one connection (Xavier, 2008). There have been suggestions for European Union (EU) countries to adopt Broadband as a basic service, thereby creating USO for Broadband (Nucciarelli, Sadowski, & Ruhle, 2014).

Though the quest for a generally acceptable basic service for Broadband services is in progress, different countries in their National Broadband Policies have specified the services they consider basic for their citizens. The result of this variance on what should be set of basic services is that, different countries define Universal Access and Universal Service of Broadband infrastructure and service in their

National Broadband policies differently. The variance in the delivery of Broadband infrastructure (both fixed and wireless) stems from the expected data rate and capacity the country decides to deliver to households (Williams & Falch, 2012). As a result of these diverse definitions, different countries have identified different services, they feel is basic within their jurisdiction. In some cases, the these basic services are neither mentioned nor specified. However, in some cases as seen in box 2.2 below, the basic services are all inclusive of whatever the Broadband network can deliver.

Although these diversities in National Broadband Strategies exist, in literature, Universal Access and Universal Service of Broadband infrastructure and service has been defined as follows:

- Universal access is defined as omnipresent access to service or access anywhere

- Universal Service is defined as the individual or household usage of the service.

(Blackman & Srivastava, 2011)

Box 2- 2 Current Universal Access Definitions of the US and UK

USA

- The availability of quality services at a just, reasonable and affordable rate.
- Access to advanced telecom and information services, in all regions of the nation
- Access in rural and high cost area
- Equitable and non-discriminatory provision towards Universal Service is expected from all network providers
- ‘Specific predictable and sufficient Federal and State mechanisms to preserve and advance Universal service’
- Access to advanced telecommunication services for schools, health care and library

UK

The network technology of choice was any technology that would enhance electronic communications (UK National Archives, 2014). These networks were to be made available throughout the UK.

Source (Williams 2015)

THE FUTURE OF UNIVERSAL ACCESS AND UNIVERSAL SERVICE POLICIES

As technology changes, and the market needs change, so will the concept of Universal Access and Service evolve. Hudson (1997) identified UAS as a moving target (Hudson H. , 1997). Universal Access and Universal Services policies may never have a standard definition in our life time.

2.1.1 CHARACTERISTICS OF UNIVERSAL ACCESS AND UNIVERSAL SERVICE

As mentioned in the introductory part of this sub-section, the concepts of Availability, Accessibility and Availability are the highlights of Universal Access and Universal Service. In literature, it has been mentioned that the UAS concept can be explained with respect to network infrastructure availability, network and service, accessibility and service, affordability (See (Benjamin & Dahms, 1999) (Liu & Wu, 2013) (Organization for Economic Co-operation and Development), 1991)).

Availability: Availability for Universal Access in the provision of fixed-line telephony implied access to network connectivity and availability for Universal Service implied the availability of telecom service (Intven, Oliver, & Sepulveda, 2000). However, in the provision of mobile telephony, Broadband Internet infrastructure and Service and NGNs, Availability for Universal Access implied the existence of network infrastructure and service through community, public or shared devices (Blackman & Srivastava, 2011). Availability for Universal Service implied blanket coverage, private service on demand, free and speedy subscription and emergency calls (Blackman & Srivastava, 2011).

Accessibility: Accessibility to telephony was first mentioned in the United States Communications ACT of 1934. It implied the ability of the disabled to use ICTs (US Department of Justice, 2013). In the amended act of 1996, the clause still exists (US Congress, 1996). The accessibility bit of the UAS concept can also be explained with regards Assistive Technologies (Stephanidis, 2001) (Shneiderman, 2000). However, over time, accessibility for Universal Access was broadened to include facilitating telecom connectivity to convenient locations and walking distances (Blackman & Srivastava, 2011). The concept of accessibility for Universal Service was extended from just providing services for the disabled to the provision of reasonable Quality of Service (Blackman & Srivastava, 2011).

Affordability: Affordability implied the affordability of the service to all citizens (Blackman & Srivastava, 2011). The first policy aimed at affordability was the United States Communications ACT of 1934. The policy directive demanded “Non-discrimination in pricing based on a particular person, class of persons or locality”

ICTs (US Department of Justice, 2013). Affordability for Universal Access implies the ability of the user to be able to pay for the service with existing national legal tenders such as cash or cards and flexibility in subscription (e.g. Pay as you go, etc.) (Blackman & Srivastava, 2011). Affordability with respect to Universal Service implies the existence of service and price differentiation to cater for all classes of people in the society (Blackman & Srivastava, 2011). Examples of service and price differentiation are the delivery of different ranges bundles and subscriptions for the telecom service.

In section 2.3, the rationale for UAS policy in literature is discussed. However, these characteristics of Universal Access and Universal Service policies form the basis of Universal Access and Service policies.

2.2 WHY UAS PART 1 – HISTORICAL OVRVIEW OF US

In section 2.1, an attempt was made to define UAS. The next rational question would by why UAS? In order to answer this question, the historical timeline is adopted to identify how UAS has been viewed in the delivery of telecom infrastructure over time. Here one would understand from the literature the motive behind UAS in a different era of telecom infrastructure and service evolution in selected countries. The caveat here is that the historical categorization is not aimed at declaring that these reasons were universal to every country. On the contrary, the attempt here is to pinpoint some Universal Access or Service initiatives and find out why it was so. The time frame ranges from the Pre-telegraph era till date. In the next section, the why question will be viewed from the academic literature point of view.

2.2.1 PRE – TELEGRAPH PERIOD

From the network connectivity point of view, the Universal Access to ICT and telecommunications infrastructure and services can be viewed as universal coverage or more accurately, universal connectivity. Universal Service at the other end denotes the adoption of the service, either at the household or individual level. Before the advent of the telegraph (optical and electrical telegraphs) the mode of communication was primitive and did not require telecommunication networks. Hence, it was not necessary to research into literature on how Universal Access and Universal Service meant in those days.

2.2.2 TELEGRAPH ELECTRIC TELEGRAPH PERIOD

The evolution of the optical telegraph was disrupted by a disruptive innovation, the electric telegraph. This was because the electric telegraph transmitted signals at a faster data rate with cheaper infrastructure than the optical telegraph. The high cost of deploying the optical telegraph and the slow data rates it produced made it impossible for the Universal Service of the optical telegraph to be envisioned either by the public or private sector (John, 2010). The invention of the electrical telegraph changed the dynamics of telecommunications for both the public and private sectors. It provided the means for instant message delivery over long and remote distances. For the public sector, the telegraph was a valuable aid for inter and intra governmental business dealings (Berthold, 1922). It was also helpful during crises as in time of war. For example the Brazil-Argentina war and the American civil war among others (see (Berthold, 1922) (Shaw & Terry, 2014). For the private sector, there was a possibility for individuals on a daily basis to communicate with friends, relatives, in the conducting of businesses and operations of the financial markets (Nonnenmacher, 2014). There was also the possibility of facilitating communications between trains and between ships. These possibilities provided commercial opportunities enabled by the electronic telegraph that had to be exploited.

Although these possibilities existed during this era, there was no public discussion on Universal Access and Service policies. However, there were individual public and private initiatives in the 19^{th} century in the west towards extending the coverage for the telegraph services.

PRIVATE INITIATIVES

The private initiatives were commercially motivated. The private sector did not view Universal Access and Service as we know it today as their objectives. However, from their actions, Universal Access and Service Initiatives as we know today can be identified. These private initiatives were meant at unifying private telegraph infrastructure via horizontal integration. Hence the concept of Universal Access to the telegraph service was facilitated by unified service initiatives. This initiative led to market failures, where natural monopolies emerged in some regions of the United States and in the UK. An example of a unified service initiative is mentioned in the box below.

Box 2- 3 The Case of Western Union

An example of this is the case of the merger between Hiram Sibley's New York and Mississippi Valley Printing Telegraph Company and Ezra Cornell's New York & Western Union Telegraph Company. Both men named the new company Western Union and its sole purpose was to create one telegraph system with unified and efficient operations (Nonnenmacher, 2014). Series of take corporate take overs and buy-outs led to the merger of the two biggest telegraph companies, Western Union and the Atlantic and Pacific Telegraph company to form a monopoly called, The American Postal Telegraph company (Nonnenmacher, 2014). But they made the first effort in attempting to attain Universal Access for telegraphy in the United States of America.

In the west, the approach towards unified service occurred in a divergent manner as seen in the table below. The divergence here refers different countries taking different approaches towards a Unified Service. The US and UK cases are examples of these divergent paths. The US Telegraph market began as a competitive market. However, over time, horizontal integrations occurred. But at the entrance of telephony into the telecoms market, few competitors existed.

Table 2- 2 Examples of some Private Telegrapgh Initiatives and Markets in the West

	Former name	**Name today**	**Date established**	**Initial Market structure**
UK	Cooke and Wheatstone Telegraph, later called Electric Telegraph Company	British Telecom	1846	Natural monopoly (Market failure) and later state owned monopoly
United States	Lots of companies	-	-	Competitive market

Source (Williams (2015))

In the UK, the telegraph market began with very few operators who later underwent horizontal integration to become natural monopolies and later down the line a state owned monopoly.

In some developing countries, private commercial interest in telegraphy was rare. In India and Brazil the public sector was charged with developing the telegraph infrastructure (Berthold, 1922) (TRAI, 2014). In Brazil, the telegraph infrastructure was developed by the private sector to aid in facilitating a faster communication during the Brazil Argentina war (Berthold, 1922). In Africa, the telegraph was developed to serve the colonial interest; hence the telegraphs linked remote colonial offices (See (Allotey & Akorli, 1999) (Ajayi, Salawu, & Raji, 1999)). The colonial interests were mostly in trade and the transportation of the goods from the hinterlands to the coasts. This was the practice till soon after the independence of some African countries.

Despite the divergence in the private sector approach towards Unified Service existed, one would see these approaches as a means of facilitating Universal Access of the Electric Telegraph. One would not write off the fact that these approaches were aimed at serving private interest.

PUBLIC INITIATIVES

The public initiatives identified in the course of this research were public infrastructure development as well as regulation.

Public Infrastructure Development*:* The public initiatives were not entirely commercially motivated as they had the vision of extending the coverage of the telegraph in their respective countries. Aside Denmark, Scandinavian countries such as Norway and Sweden took the initiative of developing a public telegraph system with what we know today as 'Universal Access' (See (Tomas, 2014) (Derdak & Hast, 1992)). These countries established state-operated monopolies for the purpose of establishing the telegraph infrastructure. The table below presents the name of the national monopolies of the Sweden and Norway at were established for the purpose of facilitating Universal Access of the Electric Telegaph. In other parts of the world such as the United States, public infrastructure development of the telegraph occurred via the direct financing of telegraph companies to expand their infrastructure along rail lines. The aim was to bridge the east coast to the western coast of the United States. It was also aimed at interconnecting public agencies in the country (See Pacific Telegraph Act of 1860 and subsequent Pacific railroad ACTS of 1862 and 1863 (CPRR (a), 2003; CPRR (b), 1993)). This initiative in the US was not aimed at serving the populace, but one could see it as an indirect act towards Universal Access. This is because, the people went to the train stations and post offices to wire their messages. Hence the infrastructure did serve the people as well.

Table 2- 3 Overview of the Swedish and Norwegian Scenario

Former name	Name today	Date established	Country	Initial Market structure
Kongl. Elektriska Telegraf-Verket	Telia	1853	Sweden	Monopoly
Telegrafverket	Telenor	1855	Norway	Monopoly

Source (Tomas, 2014) (Derdak & Hast, 1992)

Regulation: Regulation of the telegraph was not always aimed at ensuring Universal Access and Service, but to facilitate connectivity of public institutions and post offices. Examples could be seen in the case of the UK, US, Canada and India - to mention a few. The examples are mentioned in box 2.4 below. The telegraph era is not often acknowledged in the discussion of Universal Access and Service. However, it will not be wrong to say that this era was not a precursor to the importance of ICT infrastructure development and service delivery. The need for speedy information delivery with regards to government activities, economic activities and social activities was birthed along with the birth of the commercialization of the Electric Telegraph. This gave led to the Scandinavian public sector and western private investors like the Western Union to dream of everyone having access to the telegraph service.

Box 2- 4 Examples of Approaches towards Telegraph Regulation

UK: There were few UK regulations aimed at regulating telegraph development. These were. The British regulations towards the telegraph development regulating the right of way (Telegraph ACT 1863), extension of coverage to the Channel Islands and the Isle of Man (Telegraph ACT 1868) and a semblance of Universal Access where the Telegraphs were to be installed at Post offices (Telegraph ACT 1878) (Departmeno de Tecnologia Fotonica Y Bioingenieria). In UK, their approach towards Universal Service was to attach Universal Service Obligation to British Telecom's 1983 Licence where they were mandated to provide telephone services everywhere and in all rural areas (Milne, 1995).

US: The US telegraph Acts were aimed at developing telegraph infrastructure, not necessarily for the public but for the use of postal agencies, the military and for other purposes. (See Pacific Telegraph Act of 1860 and subsequent Pacific railroad ACTS of 1862 and 1863) (CPRR (a), 2003; CPRR (b), 1993) . These ACTs enabled public funding of Telegraph infrastructure as well as further strengthen the partnership between the railroads and the telegraph as already being done by the private sector.

Canada: In Canada, the Canadian Railway Act of 1906, an amendment to the railway ACT of 1903, regulated the development and maintenance of the Telegraph (Macmurchy & Denison, 1911). Clearly there was no Universal Assess or Service objective here as the Canadian Government saw the telegraph purely a private sector initiative. However, the ACT authorized railroad companies to run telegraph services as well as grant the Canadian Government the exclusive right as at when needed to use the telegraph for Government Business.

In conclusion to this sub-section one would say that, from both perspectives there were deliberate moves towards attaining Universal Access and possibly Universal Service.

2.2.3 TELEPHONY PERIOD

The conscious, progressive moves towards attaining Universal Service began in the telephony era in the USA. As will be mentioned later in the case of the United States, the practice of attaining Unified Service did spill over from the predominant telegraph period to the deployment of fixed line telephony. In Europe, there were attempts aimed at Universal Service as well. In this section literature is reviewed with regards Universal Service in the United States and Universal Access and Service in Europe. The concepts of Universal Access and Universal Service are not used interchangeably in this section.

THE CASE OF THE UNITED STATES

There are some that argue that the concept of Universal Access and Service was derived from the US communications act of 1934 (see (Shneiderman, 2000)). In this act, the provision of telephone, telegraphs and radio services at reasonable prices, particularly in rural areas without discrimination based on race, color, religion, national origin and sex were promulgated (US Department of Justice, 2013). The act also did make provision for access to individuals with disabilities to be accommodated in the production of the then Customer Premise Equipments (CPEs). One would say that with regards to regulating telecom infrastructure delivery the assertion that the concept of Universal Access began with the US communications ACT of 1934 is correct. But with regards to the provision of telephony connectivity for all, one would say that the idea of universal coverage of telephony infrastructure and service was envisioned by Alexander Graham Bell (Compaine & Weinraub, 1997).

Alexander Graham Bell’s vision was motivated by the advantages of the economy of scale that a single telephony network would provide. One would say that this economy of scale possibility led him to extend his laboratory into a commercial entity, the Bell Laboratory – that metamorphosed to AT&T. Alexander Graham Bell, the inventor of the telephone in 1878 foresaw the network architecture that would enable wires, laid underground or suspended overhead linking private homes, shops, manufacturers, etc. to a main cable in a central office (Compaine & Weinraub, 1997). He foresaw that the automatic exchanges will reduce transmission cost, thereby leading to the poor being able to afford the service. His idea of universal connectivity/coverage, which we call Universal Access and Service was not different from the subsequent ideas behind the concept. However the difference lies in the mechanism of achieving the desired goal. His idea encompassed “Availability”, “Accessibility” and “Affordability” of fixed line telephony. The motive was commercial interest; hence the mechanism for attaining Universal Access and Service was by expanding the Bell Networks to the nooks and cranny of the United States while his patent lasted. In order to ensure the universal connectivity, he had to adopt the policy of inclusiveness, where there was no discrimination between organizations or individuals who are either rich or poor. He further envisioned the possibility of delivering telephone services at a cheaper cost to the poor with the future adoption of automatic exchanges to reduce cost. Unfortunately up till date, this dream is yet to fully materialize else there will be no need for this research.

However, coincidentally AT&T, a descendant of Alexander Bell's Telegraph Company played a major role towards the emergence of the concept of Universal Service. Literature review of this fact is made in the next sub-section tagged AT&T's influence on Universal Service. In the next sub-section, literatures are reviewed on the policy metamorphosis from the unified Service to Universal Service.

AT&T's Influence on Universal Service: It is believed that in 1907 Theodore Vail, the then President of AT&T, did convince the Government of President Woodrow Wilson, that Universal Service can be achieved by having a regulated monopoly with a Universal Service Obligation (Melody W. M., 1997) (Nucciarelli, Sadowski, & Ruhle, 2014). This happened during the second period of Vail's presidency at AT&T from 1907 to 1919. This was when AT&T adopted the slogan, '*One Policy, One phone, one Universal Service'*. The slogan adoption happened precisely in 1908 (AT&T , 2014). It is widely believed that this slogan was the birthplace of the concept of Universal Service (Garnham, 1997) (Nucciarelli, Sadowski, & Ruhle, 2014) (Benjamin & Dahms, 1999).

There are, arguments against this line on the History of Universal Service. Their argument is that Theodore Vail's idea of a Universal Service policy is different from a Universal Service policy aimed at promoting the affordability of telephone services via the means of cross subsidies (Bar & Riis, 2000) (Mueller, 2013). Vail's idea of Universal Service was not universal coverage, but the provision of telephony Services (Unified Service or universal connectivity) via the vehicle of a natural monopoly - in this case AT&T. Mueller argues that Vail's Universal Service policy slogan was actually aimed at getting AT&T's competitors off the market, thereby enabling AT&T to operate as a regulated monopoly.

Both arguments are valid. This is because, the concept of Universal Service as we know today was inspired by the concept of Unified Service. Also, the concept of Unified Service did not denote Universal Service – as we know it today. Hence, depending on how both arguments are viewed, they are correct. The only difference between both arguments is that, the former argument is about the intention behind the coining of the word Universal Service by Vail. The latter argument is based on the fact that Vail's creation of the word Universal Service is the inspiration for the usage of the word "Universal Service today." A literature review explaining the latter argument is explained further in the next section.

From Unified Service (Universal Connectivity) to Universal Service (Telephone in every home): To further understand this line of thought, it is important to take a look at history. The American Bell Telephone company (AT&T's mother company), owned by Bell himself had a monopoly over the Bell Patent towards telephony provision in the US from 1876 to 1893 (Radner, Radunskaya, & Sundararajan, 2014). Before the expiration of the Patent, the American Bell

Company began investing in long distance telephony infrastructure. AT&T was established in 1880 as AT&T long lines, to handle the long distance communications arm of the American Bell Telephone company, (AT&T , 2014). In other words, AT&T long lines, was the national backhaul prover owned by the American Bell Telephone company. After a corporate re-organization on December 30, 1899, the assets of the American Bell company were transferred to AT&T Long lines and the company was renamed AT&T (Hochheiser, 1989).

When the Bell Patent expired in there was a vigorous competitive telephony market in the United States. Soon AT&T and the American Bell Telephone company had 6000 competitors across America (AT&T , 2014). Theodore Vail happened to be the founding president of the reorganized AT&T as he was incidentally the President of the American Bell Company at the moment of this transformation (NNDB, 2014). The AT&T management led by Theodore Vail wondered why there had to be 6000 companies offering the same service (Advertisment, 1908). Most of these companies could only facilitate domestic connectivity, but not trunk connectivity and had to interconnect with AT&T or other smaller long distance telephone company. In most cases AT&AT was not willing to interconnect with them. AT&T also had some shares in some of the smaller companies. Hence Vail proposed the existence one system (network operator) responsible for interstate connections with a uniform system of operation and accounting? The hope was that this move will result in efficient telephone service delivery that would not have been obtained if there was competition coupled with interconnectivity issues (Advertisment, 1908). The idea of Vail's Universal Service was vertical and horizontal integration of the telephony market to ensure efficiency in the delivery of telephony services to the American public. Based on these facts Mueller (2013) is right about Theodore Vail's motivation and understanding of Universal Service was Unified Service or Universal connectivity.

Based on this policy by Vail, larger companies such as AT&T acquired smaller companies along the way and this raised anti-trust litigations. It was during this period that Vail came up with the "*One Policy, One System One Universal Service*" Slogan. The acquisitions were temporarily suspended by a notable litigation between the United States Justice Department and AT&T, for AT&T's attempt to acquire Pacific North West, a small long distance company (Temin, 1987).

The suit was settled out of court with the Kingsbury commitment. Here AT&T was represented by its then vice-president Nathan Kingsbury in 1913 (Temin, 1987). This was the first regulatory interaction between the Public sector and the telecommunications market that was unregulated once the patent laws ended. This form of regulation (The Kingsbury commitment) did satisfy a section of the American civil society and the public who had been clamoring for either public regulation or Public ownership of the telegraph networks and by extension, telephone networks as well (Parfitt, 2014). In the Kingsbury commitment, AT&T

made a commitment to stop acquiring independent competitors and to connect their competitors to AT&T long distance lines (Temin, 1987) (Shelanski, 2002) (Radner, Radunskaya, & Sundararajan, 2014). One would say at this point that AT&T's attempt to deliver its Universal Service (Unified Service) objective facilitated public interest which would lead to Universal service of telephony as known later.

Although this anti-trust regulation was in place, AT&T could still buy out their competitors as the Department of Justice (The Antitrust regulator) approved most of their special applications to buy out their competitors based on the fact that subscribers would wish to subscribe to a single network than to multiple networks that cannot interconnect (Shelanski, 2002). There was no interconnection regulation at this point, hence the refusal to connect with competing networks were high as the private sector players preferred building their own networks. The Interstate Commerce Commission (ICC) served as a consumer protection agency against unfair tariff. They were the only regulatory agency. However, they were not given powers by the Mann Elkins ACT of 1910 to regulate interstate interconnectivity issues. Another factor that undermined the Kingsbury commitment was that the public anti-trust sentiments were reduced temporarily over time as a result of an improved relation between the American society and the private sector (Temin, 1987). Most importantly, the Kingsbury commitment did not prevent AT&T to acquire or purchase stakes in telephony companies that were considered non-competitive (Loeb, 1978).

Direct regulation of telegraph and telephony became a reality in 1918 when the communication networks were placed under the supervision of the Postmaster General via the vehicle of the US Telegraph and Telephone (UTAT) Administration (Shelanski, 2002) (Parfitt, 2014). The US Telegraph and telephone Administration board was headed by the Postmaster General and his assistants. A few telegraph and telephone executives served as advisers to the board. However, the UTAT paid more attention to the telegraph infrastructure than to the telephone system, which in a sense implied that the telephone companies were not regulated by UTAT in practice.

Despite these reforms, the market growth of AT&T began to affect its competitors with whom AT&T was forbidden by the antitrust regulation from acquiring. These competitors petitioned the Government to grant relief on the antitrust restriction imposed on AT&T and the way out from the United States Government's perspective was the passage of the Willis-Graham ACT of 1921 (Loeb, 1978). Based the outcome of the market where interconnectivity was an issue and coupled with subsequent financial troubles from the competitors of AT&T, the US Government decided to reduce the telephony market to a Monopoly that will provide a Unified service (Shelanski, 2002) (Loeb, 1978) (Madden, 2010). One would say that at this moment, the congress of the United States and the AT&T ideas of 'Universal Service' were in synchronization. This can be confirmed in the process of the congress deliberation on what would be the Willis-Graham ACT, Senator Graham declared:

"*It is believed to be better policy to have one telephone system in a community that serves all the people*….."[1] (Loeb, 1978)

One would say at this point, that Government interest towards Universal Service in the United States became pronounced.

The Willis-Graham ACT did suspend the antitrust prohibitions on AT&T as well as shifting regulatory oversight from the US Department of Justice to the ICC (Shelanski, 2002). Hence the ICC had to approve mergers with the sole aim of creating a single telephone system. However ICC's mandate had no policy guidelines and it had no powers to intervene in telecom regulatory issues. After several attempts at Capitol Hill to consolidate the regulation of communication agencies to regulate one network, President Roosevelt in 1934 proposed the creation of the Federal Communications Commission (FCC) (Loeb, 1978). In the process of creating the FCC to oversee the regulation of communication services in the US, the purpose of the United States Communication ACT of 1934 was:

"*For the purpose of regulating interstate and foreign commerce in communication by wire and radio so as to make available, so far as possible, to all people of the United States a rapid, efficient, nationwide, and worldwide wire and radio communication service with adequate facilities at reasonable charges*……….." (Loeb, 1978)

At this point one would say, that although the word Universal Service (Unified Service) was not mentioned in the ACT, the US Communications ACT of 1934 was influenced by Theodore Vail and the resulting circumstance in the then telecom industry. Secondly, one would say that the line of thought would have been "from Unified Service" to "Universal Access". This is because, in the communications Act, the idea of Universal Service was not household penetration, but "*Universal Subscriber Interconnection*" or "*unified interconnection*" (Madden, 2010).

The move from Unified Service to household penetration in the United States was birthed by the call for new competition in the 1970's (Mueller, 1997). There were lawsuit between the United States Department of Justice and Western Electric (A company owned by AT&T) on the refusal of the companies in the Bell System to purchase production equipment and customer premise equipment from any other company besides Western Electric in 1949 (Economides, 2003). There was another lawsuit between the United States and AT&T in 1974 where AT&T was charged

[1] 61 Congress record, 1983 (1921)

with refusing to deal (interconnect with competitors), monopolized the long distance market, price discrimination, predatory pricing, provision of incomplete information to regulators and their exclusive relationship with Western Electric (Economides, 2003) (MacAvoy, 1996). These law suits came into effect because the terminal equipment market and the long distance market were deregulated based on the entrance of the wireless into the market (MacAvoy, 1996) (Mueller, 1997). The aim of the deregulation was to reduce the cost of deploying and producing a call other than the cross-subsidization and accounting separation initiatives aimed at reducing prices of the basic local services.

Although the prices of the equipment became cheaper as technology improved, the effect of inflation drove up the cost of AT&T’s operation (MacAvoy, 1996). In this period, the United States had recorded 90% penetration of telephony service (Mueller, 1993). The potential of household penetration driven by affordable service led the FCC to deregulate the aforementioned sections of the market for the purpose of attaining more household penetration (Universal Service) (Economides, 2003). The action of the Department of Justice on anti-trust grounds led to further discussion on Universal Service on the grounds of household penetration as the Universal Service on the grounds of Unified Connectivity was almost fulfilled.

Hence, one would say that the idea of Universal Service as we know today in the United States was the product of the uneasy marriage between public regulation and establishing Unified Service. The public sector in the midst of the evolving market had to protect the public interest. Hence Universal Service as we know today in the US emerged as the telephone was viewed as an essential infrastructure, in which everyone in the society should have access to. The best place to facilitate access was at the household level (Economides, 2003).

THE CASE OF EUROPE

It is really difficult to know when the concept of Universal Access and Service towards ICTs became a priority for some European governments during the early days of telephone development. But a careful look at the evolution of telephony development in Europe points to the fact that Universal Service became important as telephony evolved and the positive externalities of the telephone became visible. This led many European countries to nationalized telephony in the bid to control infrastructure and service delivery to the citizens. The nationalization effort was triggered by the fact that, they had the time to study the effects of telephony which was a disruptive innovation to the established electronic telegraph system. This fact is explained in this sub-section with examples.

There is another view that implies that affordability, availability and the accessibility of telephony was one of the reasons to nationalize telephony networks in some European countries such as Sweden. This was because in Sweden, one of the reasons for nationalizing was, to facilitate the economics of scale in the operation of the network and the network externalities on the demand side from the end user (Lindmark, Andersson, Johansson, & Bohlin, 2004). This argument implies that a national monopoly would be able to provide telephony at a cheaper cost to the subscriber, than in a competitive market. This is because the cost per unit of the telephone service will decrease as more customers subscribing to the service increases, and the fixed cost could be spread out on the quantity of units produced. Based on this argument, one would see the public sector aiming at telephony availability, affordability and accessibility (in this case, having access to the network to subscribe). By implication one would say that the nationalization was aimed at universal service.

This assertion of nationalizing to achieve economies of scale is true in some other cases in Europe. An example is Germany. Once Alexander Graham Bell demonstrated the ability for long distance communication to the Germans, the telephone was put under the Bundespost (Post office) in 1877 by the then Post Master General, Heinrich Von Stephan (Grant, 2003). Hence, the public sector could sense the early usefulness of the telephone to the society and decided to nationalize the telephony network from inception. The German case was not as dramatic as the case of France and the UK. In France and UK, one would see a bit of hesitation from the public before the adopting the service for political reasons and later nationalizing the telephony network. These examples are elaborated in the examples stated in the boxes below. The dramatic events in France and UK as expressed in the box below identifies other reasons not related to attaining Universal Service, that led to nationalization. This could be seen in the case of France and UK as expressed in the boxes below. Finland is added because they also had other reasons for nationalizing the telecom sector.

Box 2- 5 The Case of France

France: In France there was already a history of controlling the press (Grant & Pederson, 1998). This facilitated early regulatory control over telegraphic services leading to the eventual state monopoly of the telegraph for military and political reasons in 1851, which eventually extended to telephony (Lindmark, Andersson, Johansson, & Bohlin, 2004). However, the development of a telephony network was viewed by the French Government as expensive; hence the private sector was left to develop the service with regulatory oversight from the Government (Fredouille, 2014). This gave room to competition with three American companies, Gower, Edison and Blake telephones were given 5 year renewable concessionary licenses in 1879. These companies were not given Universal Service initiatives; rather they chose Paris, Lyon, Marseille and Bordeaux as their area of coverage (Fredouille, 2014). By the end of the year, there was a merger between Gower and Blake to be called Gower telephones and in 1800. The merged Gower telephones and Edison telephones merged under a new license to be called Societé Générale du Telephones (SGT), as they could not interconnect (Grant & Pederson, 1998). The French Government by virtue of the licensing arrangement had a buyout clause. This PPI arrangement will be mentioned in the next chapter. In essence, the Government owned the network; hence the SGT was nationalized in 1889 (Grant & Pederson, 1998). One would say that, the telephone was seen as a public good or common good as such, rather it was seen as an aid to controlling the press as well as for facilitating government business and not Universal Access.

*Box 2- 6 **The Case of Finland***

Finland: In Finland a different approach was adopted. Finnish telephony market was created out of national interest and not Universal Access and Service (Geary, Martin-Löf, Sundelius, & Thorngren, 2010). The Private Finnish Interests were not enthused by the monopoly of the Russian Grand Duchy when the Finnish telegraph System was a part of the Russian Imperial telegraph (Geary, Martin-Löf, Sundelius, & Thorngren, 2010). Hence the Finnish Senate under the Russian Tsar passed the telephony decree of 1886 that led to the licensing of the private sector to providing the telegraph services and subsequently telephony services as a way of bypassing Russian telegraph regulations (Paija & Rouvinen, 2004). The entrance of telephony in Finland led to private investments which existed till independence when the Finnish Telegraph Authority was created to man the national telegraph system and the army telephone network (Geary, Martin-Löf, Sundelius, & Thorngren, 2010).

Box 2- 7 The Case of UK

In the UK ,as in few other European nations, the entrance of the telephone was viewed by the public sector as a disruptive innovation to the established telegraph system (Calvo, 2006). It should be noted that the Electric Telegraph Company was nationalized in 1870 and controlled by the British post office (Freshwater, 2010). The telegraph infrastructure was source of Government revenue. Hence the development of the telephone had to be regulated towards very few areas. To buttress this point would be a brief history of the British telephone network.

The entrance of the telephone commercially was as a result of the initiative and rivalry between the Bell and Edison telephone patents respectively – although Bell arrived first in the UK in 1878, before Edison did in 1879 (Freshwater, 2010). The duopoly existed unregulated by the public till 1880. As the telephony infrastructure and market developed so did public interest. The public interest resulted in a court case between the UK Attorney General vs. Edison Telephone company to clarify the status of the telephone with regards the Post office as the telegraph Acts made no provision for the telephone. The externality property of the telephone was not visible then as the telephone was a new invention. The court case ruled that telephone messages were telegram and the telephone service had to be regulated via licensing as well as tariff collection from the Telcos (Freshwater, 2010). However, regulation of the telephone was placed under the office of the Postmaster-General and regulated under the telegraph Act. Telephony development was restricted to few areas. The Edison telephone company merged with The Telephone Company (Bells patents) after patent litigations in 1880 to form the United Telephone Company (Rutgers, 2012). As telephony subscription grew, so did the potential of telephony over the telegraph, this led the Post Office to convert telegraph service exchanges to telephone exchanges. This led to a new competitive market with telephony companies springing up in the UK. In 1889, the big telephone companies, the United Telephone Company, The National Telephone Company (NTC) and the Lancashire and Cheshire Telephone Company merged to form the National Telephone Company (Freshwater, 2010). They proceeded to buy up the smaller companies and a new monopoly was formed.

The NTC sought extensive powers to extend their network which they presented at the House of Commons in 1892. The public sector via the Post-Master General opposed the bill stating that: the Quality of the Telephone Services was poor, the overhead cable in town caused disquiet, and the telephone market was affecting the revenues of the Post-offices telegraph services (Freshwater, 2010). Based on the compliant from local authorities on the inefficiency of the telephone and its excessive cost, the Telegraph act of 1899 was passed to aloe municipalities outside London set up their own telephone systems. Also the Municipal Corporations Association was in favor of state control of the NTC. At this moment, there was also public financing of a telephone infrastructure service in London by the Post-Office, an offer, earlier denied to NTC. Although 13 Counties asked for license, only six did open a telephone system. Aside Hull County, NTC and the Post Office bought the rest between 1899 and 1913. By 1901, the dominant telephone operators were the Post Office and NTC and it was in the same year, that they signed an agreement to enable the interconnection of the two systems. The agreement also made room for the Purchase of NTC at the expiration of its license in 1911. In 1905, an agreement was made between the Postmaster-general and NTC fixing the conditions for transferring the company assets by 1912. By 1912, the NTC system and the Post Office were amalgamated and a national monopoly was born. At this point one would say that public could now control the destiny of the telegraph and the telephony.

Based on these three narratives in the boxes above, one would say that some effort towards the nationalization of telephony in the identified European countries were dependent on 3 plausible factors aside Universal Service in these Europe countries. These factors are namely:

- How the public sectors in these European countries perceived the telephone as opposed to the telegraph.
- The need of the Europeans nations, mentioned in the examples above to nationalize the telephone companies, contrary to that of the US approach was that of reacting to the market and technology development.
- How some Europeans countries perceived the use the telephone.

Despite the varied reasons, nationalization was common. Some examples include the UK, The Netherlands, Denmark, Finland (Lindmark, Andersson, Johansson, & Bohlin, 2004) (Geary, Martin-Löf, Sundelius, & Thorngren, 2010) (TDC, 2014). The Danish network operator was private till 1990, when it was nationalized.

The call for Universal Access and Service as we know it today occurred recently in Europe towards the end of the last Century. The inability of the public sector to supply telecommunications services led to the call for the explicit formation of Universal Service policies in the EU (Bauer, 1999). The efforts towards Universal Access and Service has been via Universal Access and Service Obligations as well as subsidization efforts either by cross-subsidization or Access deficit charges, etc. (Milne, 1995) (Lindmark, Andersson, Johansson, & Bohlin, 2004).

The Green paper of 1987 would be seen as a catalyst towards policy formulation and implementations that would lead to Universal Service via market liberalization rather than relying on Universal Service Obligations (Bauer, 1999). Today, efforts towards Universal Access of basic services are coordinated by different European countries. However, the current arguments is for Broadband to be included in Universal Service Obligations as a basic service in Europe (Nucciarelli, Sadowski, & Ruhle, 2014). At the EU level, there is no central coordination aimed at facilitating Universal Access and Service. However, in 2002, the EU parliament made a directive where the Universal Service and user rights to electronic communications networks and services were spelled out (Europa, 2010).

2.3 WHY PART 2-RATIONALE FOR UNIVERSAL SERVICE OBLIGATION FROM LITERATURE

The rationales for Universal Access and Service, just like everything about Universal Access and Service, are shifting targets. Universal Access and Service as seen in the previous section was initially aimed at providing affordable, accessible and available telephony services in the United States. At this point, Universal Service was seen as Universal connectivity or Unified service. At this moment, the objectives of the Universal Service policy as described by Mueller (1993) were:

- The Consolidation of competing exchanges (Mueller, 1993)
- The elimination of fragmentation caused by Access competition (Mueller, 1993)
- The provision of a Unified trunk service to avoid the problem of the refusal to connect (Mueller, 1993)

However, as the Plain Old Telephone (POTS) services evolved, so did the perceived usefulness of the service to the public. Telephony was seen as a necessity in which every household should own (Economides, 2003). From the developing country perspective telephony was also seen to be necessary at the community and institutional level as well (Hudson H. , 1994). It was seen as a tool that expanded human freedom (Compaine & Weinraub, 1997). From the economic perspective, it was seen as a wealth creation tool as the telephone provided faster communications for organizations as well as aids the organizing powers of individuals in an organization (Cherry, 1985). As a result of these factors, among others the notion of equity, which expanded on accessibility, in the provision of POTS was adopted as a goal for adopting universal service of ICTs.

Although the rationale for Universal Service shifts as telecom technology and services evolve, these rationales are often situated within the social, political, and economic contexts with regards to the telecommunication and ICT service of need to that country (see (Garnham, 1997) (Milne, 1998) (Compaine & Weinraub, 1997). At the international level, organizations such as the International Telecommunications Union (ITU), the United Nations (UN), the World Trade Organization (WTO), the Organization for Economic Co-operation and Development (OECD), and the World Bank, etc., these social, political and economic reasons has been cited as rationale for Universal Access and Service (See (OECD, 2006) (Hardy, 1980) (Maitland, 1984)). However, these rationales are seen from a global perspective and not from individual country or regional perspective.

Liu & Wu (2013) describe the economic, social and political rationale as follows:

Economic rationale: The effect of the adoption of ICTs towards broadening and enhancing the economy. These among others include:

- Network externality. The idea is that the larger the network, the greater the benefit other users derive from the network. (Garnham, 1997) (Liu & Wu, 2013) (Nucciarelli, Sadowski, & Ruhle, 2014)

- The use of telecoms as a substitute to other sectors of the economy such as transportation, etc. (Garnham, 1997).

- The promotion of an information society and economy with telecoms, providing access to vital goods and services (Garnham, 1997).

- Telephony as a seen as a public good based on public interest (Bertort, McClure, & Owens, 1999).

- Facilitates global competitiveness (Bertort, McClure, & Owens, 1999).

- Social redistribution (Nucciarelli, Sadowski, & Ruhle, 2014).

Political rationale: this involves adopting social inclusion as an aim towards enhancing governance. This among others includes:

- Societal advancement that will enhance or facilitate an educated and engaged citizenry (Bertort, McClure, & Owens, 1999)

- The creation of monopolies by Governments over national security concerns (Nucciarelli, Sadowski, & Ruhle, 2014)

Social rationale: this involves equity and non-discrimination by virtue of location (mostly rural areas), income level, disability, race or social standing. These factors, among others include (OECD, 2006):

- Providing connectivity to rural dwellers

- Provision of access to disadvantaged and vulnerable groups

- Provision of equal access towards emergency services for all

- The telephone was seen as an essential for participating in society and democracy (Bar & Riis, 2000)

However, as the facilitation of POTS is on the decline, the focus is now on Mobile telephony and Broadband services. This is evident in recent ITU facts and figure statistics. The statistic shows that the development of fixed line telephony in the world compared to mobile telephony has stagnated while Mobile cellular subscriptions per 100 inhabitants stands at 90% (ITU (a), 2014).

This trend indicates a shift from POTS to Broadband and Next Generation Networks, which are Internet Protocol networks. This has led to the emergence of converged networks. Telecommunication services, broadcast services and electronic communication services among others, are now delivered on one platform. This implies that separate stand alone communication services have lost their border line of distinction when delivered via Broadband.

Under the POTS regime, voice service was the priority and adopted for Universal Service. However, under the dispensation of Broadband, there are now bundles of converged services delivered via the internet facilitated by digitization and transported with high capacity networks (Hudson H. , 1994). These digital network infrastructures have provided the platforms for conducting social, economic, educational and political activities (Clement & Shade, 1999). During the early transition period between POTS and Broadband there were questions on what service (s) should operators be obliged to provide (Xavier, 1997)? Most importantly, what should be the rationale for providing the services? There has been ideas tending towards Universal Service for Broadband being dynamic. This is because Broadband network can simultaneously deliver to the end-user services such as the internet and electronic services rather than being static towards one form of service (Bhuiyan, 2004) (Hudson H. , 1994). In more recent times, with the rapid diffusion of Broadband, Universal Access and Service of Broadband has been promoted (Oğuz, 2013) (Xavier, 2008). The service of choice for Universal Service Obligation for ITU today is Broadband (Touré, 2009). Different countries around the world have developed, revised or are developing Broadband policies to facilitate the Universal Service of Broadband (ITU Press Release, 2013).

The core rationale for Universal Access and Service with respect to Broadband has not changed. It is still aimed at being affordable, accessible and available. The same applies to the social, economic and political rationales for Universal service. However, there are other rationale that could be added the aforementioned rationales, as the rationale for Universal Access and Service of Broadband is discussed. One could group the modern rationale into the following groups:

Connectivity: Universal connectivity serves as a backbone for the access, sharing and dissemination of information aimed directly or indirectly at economic development. (Hudson H. , 1994)

Building an information society: This hinges on the fact that ICTs facilitate the information creation, processing and exchange that supports sound innovation processes which will in turn create a multiplier effect for the rest of the economy (Bar & Riis, 2000).

Enhance Public good: This rationale hinges on the public sector, avoiding social exclusion of certain users to Broadband and NGNs (Nucciarelli, Sadowski, & Ruhle, 2014) .

As technology increases, so will the list of rationales. One will say that these rationales do not have fundamental differences with the ones, mentioned earlier. However, new advancement in technologies provides new usefulness of the emerging services to the society, leading to new rationales.

2.4 UNIVERSAL ACCESS AND SERVICE MECHANISMS

In the previous sections, an attempt was made to analyze how UAS is defined and why UAS was necessary. In this section, the focus is on how UAS is facilitated. The quest towards the Universal Access and Service of the POTS were enabled by different funding approaches or mechanisms. Some of the earlier approaches include, Cross-subsidies, Access deficit charges, Universal Service Obligations, Market-Based Reforms and Universality funding (Intven, Oliver, & Sepulveda, 2000).

2.4.1 CROSS-SUBSIDIES

This implies the provision of subsidies from a profitable telecom service to fund the provision of an unprofitable telecom service (Chone, Flochel, & Perrot, 2000). This practice was prevalent with national monopolies.

There are different forms of Cross subsidization. These include inter-service cross-subsidization and Intra-Service cross- subsidization (Intven, Oliver, & Sepulveda, 2000).

Inter-Service Cross-Subsidization: Subsidy derived from long distance calls and International calls is used to fund access and local calling. This was prevalent in the United States. In the United States, AT&T used the profit made in the provision of long distance telephone service to subsidize the provision of telephony in rural United States at a reasonable cost (Hills, 1989). It is believed that this practice was foisted on AT&T by the regulators as a means of judging the right proportion of costs to be loaded on local access network providers (producers of local calls) against the monopoly service (long distance) (Mueller, 1997). Inter-services cross-subsidization was also prevalent in the Central and Eastern European (CEE) countries as well as the Confederation of Independent States (CIS) (Intven, Oliver, & Sepulveda, 2000). The CEE and CIS countries adopted the cross subsidization of telephony as a means of adopting Universal Access before they liberalized their economies. An EU example can be found in the UK.. In the United Kingdom, cross-subsidization by British Telecom involved both the distribution of resources between the telephony services as well as reducing the price of rental lines and standing charges with the hope that the deficit will be recovered by higher subscription rate (Price & Hancock, 1998). The Case of British Telecom, they had no other option than to reduce the price as the regulators had price caps on the service (Price & Hancock, 1998).

Intra-Service Cross-Subsidization: This implies access price equity where access price in high-cost/low income areas such as rural areas are set at the same level as access price in low cost/high income or urban areas. Intven, Oliver & Sepulveda (2000) cited an example where business access services were charged higher to subsidize the residential access services.

Cross-subsidization as a means of funding Universal Access and Service was only viable with monopolies, it affected the demand for higher priced services, all subscribers were beneficiaries of the subsidies and the profits made from the high priced services were not always used to fund universality (Intven, Oliver, & Sepulveda, 2000). Based on these facts among others, cross-subsidization was not really advantageous as a tool for facilitating universality. However, it did help the US achieve 90% household penetration in the 1970s (Milne, 1995)

2.4.2 ACCESS DEFICIT CHARGES

An access deficit is a shortfall or the difference between the cost of line rental and line subscription charges incurred by the incumbent as a result of regulatory price control and the cost associated with the customer assessing the network (Gans & King, 2003). To make up for the deficit, a charge is usually placed on competing operators to be paid to the incumbent operator that cannot compete as a result of the price caps that brought about the deficit (Intven, Oliver, & Sepulveda, 2000). In this manner the incumbent or another operator with a Universal Service Obligation can deliver its service equitably without discrimination to attain universality. Access Deficit Charge (ADC) is a form of external cross-subsidization between two entities and are often placed on operators by the regulators in a competitive environment. An example is in the case of France (Fredebeul-Krein & Freytag, 1999). It was also a form of Universal Access funding mechanism in the UK, Canada, Australia, and India to mention a few (Intven, Oliver, & Sepulveda, 2000) (Jain, 2006). Access deficit charges are rare today, however, despite its perceived usefulness; it had some disadvantages. These disadvantages were:

- These costs were estimated by the regulator and the cost of the charge could lead to excessive payments to cover deficits (Fredebeul-Krein & Freytag, 1999).

- On the other hand, the regulator does not always have complete information from the incumbent needed to fix a charge that is acceptable to both the incumbent and the competing operators as in the case of India (Jain, 2006).

- Access deficit charges often do lead to the high cost of subsidized services, and as technology improves and the billing tariffs go lower, it becomes more and more difficult to place access deficit charges (Intven, Oliver, & Sepulveda, 2000).

2.4.3 UNIVERSAL SERVICE OBLIGATION

This concept was mentioned earlier in the introductory chapter. These are obligations placed on incumbent operators to provide the prescribed POTS service throughout certain geographical areas and often times within a time period. The obligations are often included in the licenses. These obligations differ from country to country. The table below identifies examples of some Universal Service Obligations for some countries.

Table 2- 4Universal Service Obligation for some countries

Country	**Company**	**Obligation**
Ghana	Ghana Telecoms	225, 000 new telephone lines within 5 years, starting in 1996
South Africa	Telkom	Starting in 1997, install 2.69 million new lines by 2002. Install 120, 000 new public pay phones by 2002
Philippines	9 International Licensees	Each install 300 000 new access lines within 3 years of obtaining licenses
	5 cellular Licensees	Each install 400 000 access lines within 5 years of obtaining licenses
Venezuela	CANTV	Increase telephone lines by 355,000 p.a from 1992 to 2000
Mexico	Telmex	Starting in 1990, average annual line growth of 12% p.a to 1994. Public payphone density of 2 per 1,000 inhabitants by 1994 and 5 per 1,000 inhabitants by 1998

Source (Intven, Oliver, & Sepulveda, 2000)

There are arguments on whether the Universal Service Obligations will matter beyond the POTS as a result of the fledging competition, the emergence of new technologies, technology convergence (Xavier, 1997) (Hudson H. , 1994)

2.4.4 MARKET/SECTOR BASED REFORM

This includes, privatization, cost based pricing, commercialization (corporatization) and market liberalization among others (Intven, Oliver, & Sepulveda, 2000). It is generally believed that market based reforms have played a role towards the increase in supply of telecommunication services, hence leading to affordable ICTS (Navas-Sabater, Dymond, & Juntunen, 2002). Under the POTS monopoly regime, cost based pricing and commercialization were some of the prevalent reforms. In sub-Saharan Africa, there were price caps placed on the existing monopoly. There were also efforts aimed at bringing in professionals to operate the state run monopoly. An example is the case of NITEL in Nigeria (Williams & Kwofie, 2014). However, in the late 1970’s and 1980s, there was a global rallying call towards market reforms aimed towards the liberalization of public sector utility delivery (Ghobadian, O'Regan, Gallear, & Viney, 2004). This call, championed by the former UK Prime Minister Margaret Thatcher and the former US President Ronald Reagan was aimed at facilitating the involvement of the private sector in the delivery of public services (Hearne, 2009). The telecommunication sector was not left out, as various telecom privatization efforts were adopted in both the developed and developing countries around the world. The idea behind privatization was that the private management of the telecommunication companies will do away with the inefficiency of the national monopolies as well as fund public network development with private capital (Hearne, 2009). Privatization also promoted some form of competition when a duopoly was created. Duopoly creation was common in sub-Saharan Africa as some Governments provided licensing for Second National Carriers (Williams & Kwofie, 2014). It is important to note that not all duopolies competed. Nigeria is a case where GLO and NITEL did compete.

Markets were further liberalized when competition policies were promoted in most countries around the globe. One would say that the competition led to the reduction of market entry barriers to mobile cellular markets. Competition enabled by competition policies led to mobile network expansion (Williams & Kwofie, 2014). Unfortunately, the growth of mobile telephony enabled by competition led to the stagnation or decline in the development of Fixed-line telephony. 2014 ITU statistics do not mention fixed-line telephony (ITU (a), 2014).

Today, as a means of extending telecom infrastructure into areas where the market facilitated competition is unable to cater for, Public Private Partnerships is utilized. Public Private Partnerships have been employed as an extension of private funding mechanisms for developing telecommunications networks (Williams & Falch,

2014) (Ragoobar, Whalley, & Harle , 2011). More on Public private will be discussed in the next chapter.

One would say that market reforms have been the catalyst that has transformed the telephony market from a monopoly to a competitive market with wider network coverage. Unfortunately, it has not helped much towards attaining Universal Access and service as the private sector is profit oriented entities who would not want to risk investing in rural areas or areas that are not commercially viable (Intven, Oliver, & Sepulveda, 2000). To correct this anomaly, public subsidy is often used to pay for the deficit.

2.4.5 UNIVERSALITY FUNDING

This is a program where funds are collected from various or stipulated sources (depending on the country) to fund Universal Access objectives (Intven, Oliver, & Sepulveda, 2000). The utilization of these funds exists in different part of the world. During the POTS days, they were very much involved in the installation and operation of Public-Pay phones, telecenters etc., as in the case of South American countries (Stern & Townsend, 2006). Today with the introduction of Broadband internet, these funds are used in facilitating ICTs for schools and the community. In Sub-Saharan Africa, the funds have been used in Ghana and some other African countries to build telecentres for ICT capacity building in rural areas, the Last Mile Initiative (LMI) through the provision of access the rural poor, the development of microwave towers in under-served areas for the purpose of co-location among others (GIFEC, 2014). These funds are utilized for similar initiatives in South America (Stern & Townsend, 2006). In the United States, universality funds are adopted as well. More about the nature of the adoption of the fund in the United States is found in chapter 8, section 8.1.1.

Universality funding in recent times has been utilized as a public subsidy commitment to Public Private Partnerships. An example is the involvement of Peruvian government by providing subsidy through a universality fund for the establishment of Valtron Rural Telecommunications Pilot project. This was a regional telecom operator in Peru, providing both fixed and mobile Code Division Multiple Access (CDMA) (Stern & Townsend, 2006). Universality funds still exist today. The sources of funding for universality funds include: direct funding from government; annual contribution from telecom operators (and sometimes Internet Service Providers).; Proceeds from telecom privatizations, spectrum auction, licensing concession payment; and funding from international development agencies (Intven, Oliver, & Sepulveda, 2000)

2.4.6 NEWER MODELS

As mobile telephony and Broadband networks continue to develop, there are clear indications that the previous Universal Access initiatives alone would not ensure the closing of the access gap. Hence, from the public sector, there has been the push towards leveraging new technologies and from the private sector competition has led to the leveraging of new business practices (Blackman & Srivastava, 2011). However, one would not say that the leveraging of new business practices such as the introduction of the pre-paid model was aimed at Universal Access and Service. This is because once there is competition, the network operators will be forced to become innovative and expand their networks in ways that will be of benefit to them. However, indirectly, one would say that this act could lead to the closing of the access gaps.

2.4.7 NON-GOVRNMENTAL INITIATIVES

This concept can be seen in two ways. The first is an initiative taken by a non-profit or social enterprise/organization to develop small ICT networks for their community. The second being a profit oriented entity that targets small communities for the purpose of developing mostly a Broadband Infrastructure. These are bottom-up approaches toward developing Universal Access and Service. Although their small patches of effort could result in a regional or national Universal Access and Service of ICTs, the major concern of these organizations is the universal Access and Service of ICTs in their communities.

Examples of the non-profit networks include wireless community networks and Community Broadband Networks or cooperatives. This thesis examines some of these networks. These networks exist in most part of the world aside Sub-Saharan Africa- excluding the republic of South Africa. Some examples not examined in this thesis include the Community Broadband Network Social enterprise in the UK, USI Wireless Minnesota, USA (Among so many others in US and Canada), Guifi.Net in Spain, Altred in Cloumbia, among hundreds of others scattered around the world (See (CBN, 2014) (USI, 2014) (Altred, 2014) (GUIFI, 2014). Some of these networks are either owned by the people or the social enterprise, depending on how the Broadband network came about. Most of these networks are Wi-Fi as Wi-Fi spectrum is free in many countries.

Examples of the profit oriented entities occur either through the development of commercial telecenters, rural micro network operators or commercially motivated commercial networks. The public initiatives that lead to the development the removal of the telecom license requirement for these operators. Most of these initiatives are visible in South America (Stern & Townsend, 2006). For example, in Cabina Publicas in Peru, the commercial telecentre activities here are not regulated and the operators can provide ADSL to the rural dwellers (Stern & Townsend, 2006).

2.5 CONCLUSION

As the move towards NGNs continues, Universal Access and Service may likely be about connectivity. The following questions will continue: What is Universal Access and service? What should be the basic or essential services? Why do we need Universal Access and Service? How do we facilitate Universal Access and Service? It will be difficult to predict tomorrow, but these are questions that national governments an International agencies will continue to discuss.

CHAPTER 3. PUBLIC-PRIVATE INTERPLAY

3.0 INTRODUCTION

The discussion on Public Private Interplays in the development of telecommunication infrastructure is mostly about contractual and non-contractual relationships between the public and private sector stakeholders (Gómez-Barroso & Feijóo, 2010). Public-Private Interplays includes concepts such as Public-Private Partnerships and Public Private People Partnerships (PPPP) and a host other forms of relationships discussed in this chapter. Public - Private Partnerships generally denote a contractual agreement between the Public and Private sector where both sectors utilize their skills and assets to facilitate the development and management of an infrastructure or service (Cook J. , 2007) (Gray, Hall, & Pollard, 2010) (Hodge & Greve, 2007). In other definitions Public-Private Partnership agreements have been extended to include civil societies and research institutions (Algerneme Zaken, 2014). However, the involvement of civil society in Public Private Partnerships has led some academics to rename the concept Public-Private People Partnership (Walravens, 2014).

The concepts of PPP and PPPP relate to this report. However, in this report, PPPP is not extended but identified as a PPP. But the word Public - Private Interplay (PPI) was used in this report because the aim of searching for a set of relationships or model that may aid in rural diffusion of Broadband infrastructure was not to identify one within the confines of only contractual relationships. Rather the research was facilitated to identify the best form of Public-Private engagement framework –contractual or non-contractual- to aid the diffusion of Broadband Internet infrastructure in rural areas.

The crux of this thesis is Public Private Interplays. In this chapter, an attempt is made to:

- Understand what interplay is.
- Discuss what the concept PPI is and the identifiable facets of the concepts.
- Discuss how it is adopted towards funding telecom infrastructure delivery with or without the aim of attaining Universal Access and Service.

The concluding part of this chapter is an effort made to justify why the identified reforms are PPIs. In this chapter a few PPI experiences for each identified PPI will be mentioned.

3.1 INTERPLAY

The word 'interplay' has been used in various ways. In the social sciences such as Psychology, it has been used to denote relationships, links between two concepts or mutual intrusions of concepts into each other's domain (Paulhus & John, 2002). In the physical sciences interplay signifies or denotes chemical, physical or biological interactions (example (Giguere, 1994)). In ICT, the concept interplay has been identified as an intertwining or interweaving (Viseu, Clement, Aspinall, & Tracy, 2006). It has also been identified as collaborations such as Public-Private Partnerships (Given, 2010). In other cases in ICT it has been identified as a 'Mix.' (Gómez-Barroso & Feijóo, 2010).

The Merriam Webster dictionary defines interplay as "..*The way in which two or more things, groups, etc.…..affect each other when they happen to exist together*" (Merriam Webster Dictionary, 2014).

The underlined phrases, one would agree are used depending on the context of discussion of the cited sources. These underlined words or phrases are independent and an attempt to lump it together may create some problems. Hence it is important to signify what the word interplay means of this report. To carry out this exercise the words are grouped together some root words that could be used in this thesis.

The identified words are intertwined, collaborations, mix, interaction, mutual intrusion, links and relationships. There will be many other words used for interplay in literature. However, these words are synonymous with the word "*association*". This implies that for an interplay to occur, there has to be some form of association between the entities (individuals, groups, agencies, stakeholders) involved. An association cannot be said to exist if an agency or individual is left in isolation. For a meaningful activity to occur, then there would be actions signified by the words identified as seen in the figure 3.1 below. These words will result in a possible outcome if the association is to make meaningful progress.

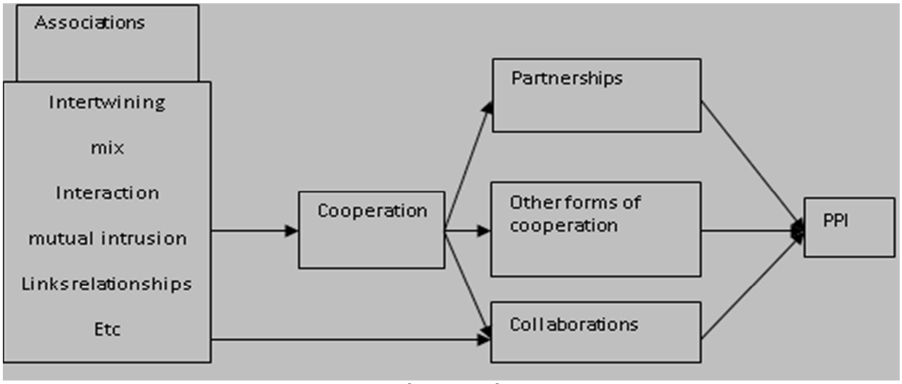

Figure 3- 1 Conceptual Definition of Public Private Interplay

The positive outcomes will lead to some form of cooperation. If the outcome of the association is negative, then the attempt to associate has failed. Cooperation is an activity between different entities (agencies, stakeholders, etc.) aimed at achieving common goals (Kozar, 2010). The form of cooperation could evolve depending on the goals in which the stakeholders hope to achieve. If the entities involved agree to pursue a shared goal, then they will collaborate. Kozar (2010) defines collaboration as an activity where different groups come together to achieve shared goals (shared responsibilities). From the legal standpoint collaboration is identified as '*cooperation between parties that are not legally bound*' (NCHV). With cooperation, individual stakeholders uphold their individual mandates while pursuing the common goal, whereas with collaborations, the stakeholders or agencies involved alter their approach to facilitate or risks and rewards aimed at the shared goal (Cook N. , 2008). Collaborations are not legally binding; they could be strong or weak collaborations. Cooperation can also evolve to Partnerships or any other form of cooperation. Partnerships are contractual relationships that involve close cooperation between two parties specifying their joint rights and responsibilities (NCHV).

As seen in the figure above, these forms of cooperation among other possible forms of associations could be regarded as interplays. In the next section, the interplay between the Public and Private sector will be discussed.

3.2 OVERVIEW OF PPIS

It is difficult to define the word Public - Private Interplay (PPI); this is because the term "*Interplay*" is a broad concept. The word public in this report denotes the Government or government related agencies (municipalities, Universality funds, ministries etc.). The word private denote profit and non-profit making organizations that have no affiliation to the government. The word PPI is used in this report to capture the broad range of possible relationships (strong or weak, direct or indirect, conscious or unconscious) between the Public and Private sector aimed at telecommunication infrastructure development. The purpose of PPI in the telecommunication sector has been mainly in the development of telecom infrastructure (Khosrow-Pour, 2014).

Based on its broad conceptual nature, PPI has been used when discussing the interaction between the public and the private sector with respect to physical infrastructure delivery and in the delivery of public services (organizational Infrastructure). '*Organizational infrastructure, establishes roles, responsibilities, authority, focus and control in the organization'* (DS Performance Group, 2014). In this section of the report, the central focus will be the use of PPI with respect to the delivery of the physical infrastructure of ICTs.

Earlier in this chapter, mention was made of other fields of endeavor where the introduction, the adoption or the study of an existing PPI occurred. In this section, more light will be shed on some sectors of the economy where PPIs has been adopted in the delivery of public services. Here one will see a brief overview of the adoption of PPIs in public service delivery and public infrastructure delivery.

PPI IN PUBLIC SERVICE DELIVERY

PPIs are evident in the legal service, social protection, consumer protection, etc. (Rein & Rainwater, 1986) (Cafaggi & Micklitz, 2009). These PPIs are often viewed from the angle of open ended forms of possible collaborations and cooperation that exist between the public and the private sector (both profit and non-profit) aimed at developing organizational infrastructures for public service delivery.

Rein and Rainwater (1986) analyzed the role of the Public sector (In their case, the welfare state) and the private sector (In their case the enterprises) in developing a joint policy aimed at providing a single social framework that protects both public and private Employees in cases of sickness, early retirement and retirements. The aim of their analysis was to do away with the dichotomy of having dichotomy of policies, where individuals from one entity (public or private) fare much better than the other entity (public or private) within the terms of reference.

Cafaggi & Micklitz (2009), analyses the concept of collective redress in dealing with consumer protection disputes in the European Union and in the United States. Here they focused on how cooperation (Interplay or point-of-meeting) could be established to avoid duality in enforcing consumer protection, hence they assessed the interplay public enforcement and private enforcement and what would be the way forward.

In the health sector in Denmark, there is this form of PPI, which is tagged Public-Private Innovation Cooperation (OPI) (Erhvervsstyrelsen, 2009). OPI is the Danish acronym of the phrase in reference. Within the OPI framework, public institutions collaborate with private companies for the purpose of innovation and developing public solutions. The incentive for the private sector in this project is to deliver tailor made solutions that are really in need by the public sector; hence the private sector is given access to public sector knowledge. The incentive of the public sector is to deliver quality service to its citizens; hence they collaborate with the private sector in the development of these new initiatives. One would say that this collaboration is made possible by the existence of mutual benefits for both parties, (public and private).

PPI IN PUBLIC INFRASTRUCTURE DELIVERY

In the delivery of physical infrastructure in the non-telecom sector, the adoption of PPI is prevalent in the West. An example from Europe and Asia include:

- The delivery of renewable energy in the UK has experienced what one would call a loosed form of PPI. The Renewable Obligations (RO) of 2002 was a market - stimulation policy document that enabled the further liberalization of the electricity market in the UK (Foxon & Pearson, 2007). The obligation was complimented with government grants and public support for research and development (Foxon & Pearson, 2007).

- Another PPI example, could be seen in the delivery of the tourism infrastructure, such as the Disney land theme park, in Hong Kong via Public Private Partnerships (PPPs) and water and energy infrastructure via (PPPs) (See (Shen, Platten, & Deng, 2006).

These examples expose two facets among other facets about PPIs. This has to do with the form of collaboration between the public and private sectors.

One would say that the former example from Foxon & Pearson (2007) was a collaboration not bound by a contractual bond. This is because both parties (public and private) do not have an agreement by which they abide by, rather their roles towards developing renewable energy intertwined. This is an example of collaboration based on the public sector, providing governance and funding incentives while allowing the private sector to invest in public or private infrastructure.

In the second case, there a collaboration bound by a contractual agreement. This is therefore a partnership between the public and private sector aimed at developing the infrastructure in the tourism and utility sectors of the economy. The second case examples are PPPs. Governance provided in this case is not sector-specific, but project specific based on achieving common goals (Jamali, 2004). In this case, the public sector provides governance to the project as its contribution to the project.

3.3 PPI AND ICTS

There is no difference in the way PPIs is viewed in ICTs juxtaposed with other sectors of the economy – as seen earlier in this chapter. One would say that the choice of words aimed at describing PPIs differ. The only difference one might say is that the adoption of PPIs with regards to public ICT delivery focuses more on physical infrastructure delivery than organizational infrastructure creation (see (Feijoo, Gomez-Barroso, & Bohlin, 2011) (Gómez-Barroso & Feijóo, 2010)). The discussion in this section is focused on PPIs aimed at physical infrastructure delivery. However an example of a PPI aimed at organizational infrastructure creation for can be found in Rwanda. The Rwanda Health Information Exchange is the program facilitated by the Health Informatics Public-Private Partnerships (HI PPPs) (Jembi, 2014). This example of PPI is a collaboration between the Public Sector, Private sector and international donor agencies to facilitate health care services in Rwanda. Such PPIs are aimed at ICT service delivery.

PPI has been viewed as the reintroduction of public involvement in the facilitation of telecom infrastructure (Given, 2010). This section of the report takes as a different approach towards its view to PPI without disagreeing with Given (2010). The point of disagreement is based on the fact that PPIs can be identified in the facilitation of telecom infrastructure delivery, if one looks back into history. If one analyzes the word interplay as seen in section 3.1, then one would agree that the influence of the public sector has never diminished with respect to telecom infrastructure delivery. However, their mode of engagement with the private sector varies over time. In section 3.4, an attempt to identify PPIs at various points in the history of telecom infrastructure development is made.

However, in this section, the discussion is about why PPIs are adopted in ICTs and how PPIs has evolved in the development of telecommunication infrastructure. The limit of discussion in this section is the non consideration of the level of cooperation, collaboration or interplay.

PPI in the delivery of ICT infrastructure delivery is a concept that has been used in recent times when discussing the interaction between the public and private sector towards Broadband delivery (See examples such as (Gómez-Barroso & Feijóo, 2010) (Nucciarellia, Sadowski, & Achard, 2010) (Viseu, Clement, Aspinall, & Kennedy, 2006) (Williams & Falch, 2012)). The general discussions on this issue have been based on ensuring Universal Service, '*connectivity to all*,' by investing in infrastructure developments via PPIs. In these cases PPIs are often discussed either from a collaborative point of view or from a partnership point of view. Current discussion on partnerships aimed at developing Broadband infrastructure has been Public-Private Partnerships (see (Given, 2010) (Nucciarellia, Sadowski, & Achard, 2010) (Williams, Adjin, & Tsivor, 2014)). More about this form of PPI will be discussed later in this chapter. The collaborative point of view has been based on the idea of the new public interest towards telecom (Broadband) infrastructure development via direct action and indirect action. Direct action involves facilitating the supply side of the market via subsidies and other forms of interventions, mediation via governance. Mediation via governance involves defining market rules. The indirect actions involve the provision of tax incentives to suppliers, complementary infrastructure development among others (Gómez-Barroso & Feijóo, 2010) (Kushida, 2013).

There has also been a discussion of PPI from the Internet service delivery point of view. The literature discussion on this subject outlines the collaboration that exists between the public sector and the private sector in via the delivery of Internet services via commercial telecenters (Beltran, 2014).

However, if one would look back it is evident that PPIs has been evident at one time or the other in the delivery of telecom and ICT infrastructure. In section 3.4 the types of PPIs identified from different countries from the Electric Telegraph period till date will be discussed. This will provide an insight into the different forms of collaborations and partnerships over time

3.3.1 RATIONALE FOR PPIS AND ICT

Under the Keynesian economic environment, public investment towards infrastructure development (telecoms infrastructure inclusive) except in the United States was seen as the best way of providing public utility as a social service to the people (Hearne, 2009). Coupled with the inefficiencies of the national monopolies and the call for reforms from the neo-liberals, there was this shift to a market based economy where competition was seen as the driver of economic growth (Melody W. M., 1997) (Mustafa, Laidlaw, & Brand, 1997) (Bauer, 1999).

Aside the general reasons for the reforms, different regions and countries had varied reasons for joining the reform '*bandwagon*'. This can be viewed from a developed and a developing country perspective.

DEVELOPING COUNTRY PERSPECTIVE

An example would be that of sub-Saharan African countries. Most of the countries here are developing countries. Sub-Saharan African countries had to join the reform wave as they were not only plagued with the inefficiencies of their monopolies, as the rest of the world. But the telecom monopolies in sub-Saharan African countries were small in size - with respect to their operational and management expenditure with respect to the market (Mustafa, Laidlaw, & Brand, 1997).

DEVELOPED COUNTRY PERSPECTIVE

In the developed world, Melody (1998) cites the inadequate performance of the P&Ts in the face of the evolving economic, political and social state of affairs as reasons for adopting market reforms. He also indicated that the reason for this dilemma was as a result of national telecom monopolies operating as international cartels, hence they could not meet the challenges of the changing social, political and technological environment. One could identify some of these challenges in two cases, one in France and the other in Germany as seen in the case box 3.1 below.

Box 3- 1 Examples of France and Germany

France: In France, the monopolies were not necessarily small in size as France Telecom was a major telecommunication player globally. The stature of France Telecom and public shareholding other factors that led to the late adoption of reforms by the French (OECD, 2003). However its monopoly status made it slow in adopting innovative technologies as a result of bureaucracy, hence it had to play catch up (Grant & Pederson, 1998). Secondly the French were forced to adopt telecom market reforms due to the potential of market competition to facilitate and information economy and the possibility of Universal Service (Grant & Pederson, 1998).

Germany: In the former Western Germany, high cost of Bundespost's telephony, its inefficient telephone networks and a retarded telecoms market were reasons why the call for reforms were loud in the 1970s (Grant, 2003) . The calls for reforms with regard the aforementioned issues in Germany died down when German unified in 1989 and West Germany's Bundespost merged with East Germany's Deutshe Post. This was because the issues of inefficiency were eliminated by the management of the merged company. The call for reforms in Germany came as a result for the need to create a competitive telecom market for the purpose of continuously improving the German digital telecom infrastructure. This inspiration came as a result of the huge cost in the development of the 40, 000 km of fibre optics backbone network linking the former Eastern and Western Germany (Grant, 2003).

One could find more varied reasons for other countries adopting market reforms around the world from each country's perspective. An example is Finland. However, Finland was an exception as they already had an innovative market with the existence of different monopolies in rural areas and regions connected to the Incumbent carrier that had no commercial incentive to invest in rural areas (Paija & Rouvinen, 2004). However, during this era, through market based reforms, as mentioned in chapter 2, telecommunication infrastructure development was gradually becoming more of private initiatives globally.

3.3.2 EVOLUTION IN PPIS IN TELECOM INFRASTRUCTURE DEVELOPMENT AND UNIVERSAL ACCESS

One would say that this was a full circle where telecommunication network and infrastructure returned to private hands as it were, at the dawn of the 20th century (Given, 2010). The role of public involvement in the early years of telephony development is different from the role of public involvement today. Initially, before the monopoly era, the role of the public sector ranged between no interest in providing financial and regulatory incentives towards establishing telecom networks and the establishment of telecom networks as will be seen later in this chapter. These incentives for facilitating telecom infrastructure before the national monopoly era, as seen in chapter 2, were aimed at controlling the network infrastructure for political reasons and to necessarily expand it. Today, as mentioned earlier in this section, there are new forms of public involvement in the development of telecom infrastructure.

PPI during the monopoly era of telecommunications in most developed and developing countries were driven by the public sector. This was because telecom infrastructure ownership and development was controlled and regulated by the public sector. The private sector was either equipment manufacturers or equipment installation companies. However, just before the advent of telecom reforms or at the start of telecom reforms, certain interactions occurred between the public and private sectors in the form of contracting, regulations, corporatization and joint ventures. More on these concepts are discussed later in this chapter under types of PPI in the monopoly era in section 3.4.

However, if one would look back to the dawn of market reforms of the late 1970’s and 1980s, one would realize that there have been specific collaborations that have enabled telecom infrastructure development. Some of these collaborations include privatization, commercialization, liberalization, de-regulation, market incentives, Public Private Partnerships and Private Financing Initiatives, turn-key contracting, Subsidies etc.. Some of these concepts with respect to PPIs will be discussed in this chapter in section 3.4. Hence, based on these facts, one would not say that PPIs are new; rather one would say that the identification of these concepts as part of the PPI “bubble” is new.

The reason the concept PPI is used today is as a result of seemingly non-traditional ways the public sector now engages with the private sector towards telecom infrastructure and service delivery. PPI in the development of the telecom industry has been seen as the re-emergence of public involvement towards the development of public infrastructure (Gómez-Barroso & Feijóo, 2010). Gómez-Barroso & Feijóo (2010), identify the origin of the terminology with regards to telecommunication infrastructure delivery to have occurred in debates during the second-half of the 2008 economic crises on how to facilitate Broadband infrastructure, at the moment the private sector was recovering from the economic crises. Kushida (2013) explains further that within this period of the financial crises, network operators were financially handicapped to finance high cost Broadband and Next Generation Networks. The public sector, especially in the EU had the vision of building an information society powered by high capacity Broadband (Nucciarellia, Sadowski, & Achard, 2010). However, this dream could not be achieved because during this crisis as the private sector were either unwilling or unable to build these high investment capacity networks by themselves (Kushida, 2013). Hence the public sector had to intervene via forms of direct financing mechanisms to spur the expansion of private Infrastructure and in some cases public infrastructure delivery. This interplay between the public and private sector was christened Public-Private Interplay.

However, based on these facts with respect to collaborations, partnerships and financing initiatives, it would be safe to say that within the ICT sector, PPIs are a broad range of possible relationships between the public and private sector that are aimed at achieving the public goals of Universal Access and Service of basic ICT services. This implies that PPIs existed and is evolving as technology evolves. To expand on this concept, the next sections of this chapter will be focused on why PPIs are adopted in ICTs, how are they implemented or envisioned to be implemented and finally what are the various forms of PPIs that have been adopted or are adopted towards the development of Broadband infrastructure.

3.4 TYPES OF PPI

As mentioned in the section 3.3, PPI may be a new concept, but in practice it has always been there. PPIs in telecommunications could be identified in 4 different periods in the history of telecom infrastructure developments in some countries. These periods are as follows:

- The early development of the telegraph and the telephone.
- The period of public involvement with telecom infrastructure development (Monopoly era)
- The market reform
- Post-extension of market reforms (current times)

The categorization of these periods is not representative of global adoption towards PPI from the historical perspective. This is because the degree and level of implementation of telecom infrastructure development varied from country to country. However the categorization of the period is aimed at identifying the reference point in history. In each historical reference point, identified PPIs in some countries are identified and explained.

This historical timeline is represented in the table below. The table presents a brief summary of the contents of this section.

Table 3- 1 Some Identified PPIs at various points in recent history

Historical Timeline	**Early Development Of The Telegraph And The Telephone**
Type of PPI	Partnership via governance
	Public funding of Private Network Initiative
	Complementary and competing Public Infrastructure Networks
Historical Timeline	**The Period of Public Involvement with Telecom Infrastructure Development (Monopoly era)**
Type of PPI	Contracting (Service Contracting, Management contract)
	Regulation
	Corporatization (Public/Private, joint stock company)
	Joint ventures
Historical Timeline	**Market Reform**
Type of PPI	Privatization
	Liberalization
Historical Timeline	**PPIs Today**
Type of PPI	Public collaboration with Community based networks
	Public investment into the development of Next Generation Networks
	Public Private Partnerships

Source (Williams (2015))

In the next sub-sections, each historical timelines and types of PPI in each timeline are explained in detail.

3.4.1 TYPES OF PPIS DURING THE EARLY TELEGRAPH AND TELEPHONE DEVELOPMENT

PPIs within this era occurred in three ways, namely: Partnership via governance, public funding of private network initiatives, complementary or competing public infrastructure development. It is important to note that these forms of cooperation were not necessarily aimed at Universal Access and Service. For the public sector, the initiatives were aimed at facilitating connectivity to support government business and post offices as mentioned in chapter 2, section 2.1. For the private sector, the initiatives were aimed at achieving economies of scale as mentioned in chapter 2, section 2.1. However, some of these initiatives still exist today. These initiatives are now aimed at Universal Access and Service. The reason for mentioning it is was to point out that certain initiative adopted today towards Universal Access and Service is not new. They existed under a different circumstance.

PARTNERSHIP VIA GOVERNANCE

As mentioned earlier in chapter 2, there was a partnership between the western governments and private telegraph operators towards the development of telegraph infrastructure along rail lines. The public sector provided governance while the telecom infrastructure was initially mostly in private hands. However, via regulations and goal setting, the public sector did outline what it wanted and directed the private sector to do so. In this case they were servicing regular customers and the public sector, who would achieve their said objective of providing communications infrastructure to support government activities. governance rather than government was adopted at this moment because telecom infrastructures were owned by the private sector and it was a new market in which the public sector did not really know what to make of it.

PUBLIC FUNDING OF PRIVATE NETWORK INITIATIVES

This occurred via direct funding of proposed telecom network facilitation initiatives and via indirect funding via Public development of infrastructure for the private sector.

Direct funding of proposed network initiatives*:* The first way was the provisions of funds that enable investors develop their proposed networks. Examples can be seen in the box 3.2 below.

Box 3- 2 Examples of Direct Funding Initiatives

One example not mentioned in chapter 2 was the financial incentive given to the International Bell Company that led to the establishment of their European Headquarters and network in Belgium (Alcatel-Lucent, 2013).

Another example would be the award of the Volta Prize of 50,000 Francs for the invention of the telephone to Alexander Graham Bell by the L'Academie, representing the Government of France in Paris (Biographiq, 2008). This example would of course be controversial as one would not call it a partnership or collaboration as it was just a prize. But indirectly, one would say that without that Prize, Maybe there would be no AT&T today as Bell used the money to establish Volta Labs (the Parent of (AT&T)). One could call this an indirect cooperation.

As mentioned in chapter 2, the United States in order to advance the telegraph for their strategic public needs provided public funds for the development of telegraph infrastructure from coast to coast.

Indirect funding via Public development of infrastructure for the private sector: There are 2 examples of this initiative among others not mentioned in this report. These examples are represented in the box 3.3 below. Both examples involve public infrastructure development for lease by license network operators.

Box 3- 3 Examples of Indirect Funding Initiatives

France: In France this form of indirect funding occurred in the form of a Public Private Partnership, where the state constructs and services telephony network for the license holders, while the license holders own and deliver the service (Fredouille, 2014). This arrangement favored the state as the condition for licensing permitted the state to buy up the privately owned equipment at any time.

UK: In the UK, the Post Office, who incidentally operated the telegraph system, developed the telephony trunk routes, for the market player as mentioned in chapter 2. One is not sure if the finance was, from the income accrued from the network operator or from elsewhere.

COMPLEMENTARY AND COMPETING PUBLIC INFRASTRUCTURE DEVELOPMENT

At face value, it is difficult to call this concept a form of collaboration or partnership as competing networks do not have the similar goals and aspirations. However, collaboration towards interconnectivity did occur between the public and private network operator. In most cases the operator of the backhaul was the public sector, while the access networks were owned by the private sector – sometimes regional private monopolies. In this case partnership for effective telegraph transmission had to be facilitated at the point of interconnection between the public and private networks This was evident later in the UK as mentioned in chapter 2. In Finland, the then national operator Tele Finland was not able to compete with the existing regional companies which existed before independence and mentioned in chapter 2. Hence Tele-Finland provided telephony in rural areas and established a monopoly on long-distance and international traffic (Karlsson). Hence the collaboration between the Public and private sector also was facilitated by the need to interconnect as mentioned earlier.

3.4.2 TYPES OF PPIS DURING THE PERIOD OF PUBLIC INOLVEMENT WITH TELECOM INFRASTRUCTURE DEVELOPMENT (MONOPOLY ERA)

This section identifies the possible forms of relationships that existed during the monopoly era. There was a shift in interaction between both sectors for the purpose of telecom infrastructure delivery. The reason for the shift in the interaction between the Public and Private from the early telegraph and telephony days were because; the Public sector in most countries now owned the telephony infrastructure. Hence, the public sector decided how and what best means they could engage the private sector in order to attain Universal Access and Service. It was during this period as mentioned in chapter 2 that importance of telephony rose to it becoming an essential service.

In the monopoly era, private sector services were initially acquired via public procurement by the public sector (Stephenson, 2003). The relationship between the public sector and the private sector was not an equal relationship, but a Principal-agent relationship. The public sector was the principal and the private sector, the agent. This relationship was struck via contractual agreements. The agent's duty as either to build or operate public infrastructure. This was carried out via service or management contracting. Later, as the call for greater public engagement for private engagement in public infrastructure grew louder, other forms of collaboration emerged, where the public sector provided either governance (regulation) or forged partnerships with the private sector (joint ventures). These forms of collaborations: contracting, regulations and joint ventures can be identified as PPIs. The explanation of these PPIs are explained below.

CONTRACTING

There are forms of contracting that were popular in sub-Saharan Africa with regards to the cooperation between the public and private sector towards the development of public infrastructure. These forms of contracting were service contracting and management contracting.

Service Contracting: This is a contract between a private company and the public sector to develop or implement a public sector task for the public sector (Stephenson, 2003). One would say that procuring private expertise to help develop public infrastructure via public contracts are PPIs. This argument would hold because the private sector and the public sector are cooperating to achieve a common goal. The common goal in this case is more about the delivery of telecom infrastructure. Both have the common goal of telecom infrastructure delivery. However, their individual gains differ. In this cooperation, the private sector provides expertise while the public sector provides guidelines and directs how the project should go. In Africa, these forms of cooperation were common as the equipment manufacturers and suppliers such as Ericson, Alcatel etc. Supplied and installed by the private sector, an example, are Motorola's investments in Nigeria (Ajayi, Salawu, & Raji, 1999), and the relationship between telecom equipment vendors and manufacturers in South Africa (Horwitz, 1999).

Management contracting*:* This involves a private management team working with existing public staff (Stephenson, 2003). The partnership here with respect to telecom infrastructure development lies in the leveraging of joint competence to manage the telecom network by the public and private sector entities. The table below highlights some African countries that began their reform process with management contracts.

Table 3- 2Examples of Countries with Previous Management Contract Relationships

Country	National Monopoly	Private company
Botswana	Botswana Telecommunications company	Cable &Wireless
Madagascar	STELMAD	France Cable et Radio
Guinea	Sotelgui	France Cable et Radio

Source: (Mustafa, Laidlaw, & Brand, 1997)

REGULATION

This was necessary when the national monopolies were privatized. One would not identify the structural separation of the operations from the regulatory function of P&Ts as PPIs. However, after the privatization exercises of national monopolies, one would say that the resulting structure was a PPI. The public sector provided regulation, while the private sector either owned and maintained the network or partially owned and maintained the network. One would say that the private sector involvement is aimed at making profit. However the public sector involvement is aimed at facilitating an essential service to its citizens (Melody W. M., 1997). An example of such was mentioned in chapter 2 where AT&T was regulated by the FCC to deliver telecommunication services to poor rural areas at an affordable cost.

JOINT VENTURES

This is another form of partnership that could be identified during the monopoly days. Hodge and Greve (2007) identify joint ventures as Public - Private Partnership with tight financial and organizational relationship. Kogut (1988) defines a joint venture as an activity that occurs when two or more firms merge a portion of their resources to form a common legal organization (Kogut, 1988). Joint ventures differ from contracts as cooperation is not administered separately or externally by the merging entities, but internally within the organization of the merged entity. In sub-Saharan Africa, joint ventures were evident between the national monopolies and the private sector. Eritrea as a new country licensed its national monopoly as a joint venture to enable international traffic via New York (Mustafa, Laidlaw, & Brand, 1997). Still in sub-Saharan Africa, in 1992 cellular technology was introduced into Nigeria by a joint venture firm called Mobile Telecommunications Services (MTS). MTS was a joint venture between NITEL (the national monopoly) and Digital telecommunications of Atlanta (Ajayi, Salawu, & Raji, 1999).

3.4.3 TYPES OF PPIS AT THE DAWN OF MARKET REFORMS

The advent of market reforms introduced new forms of partnerships, collaborations and cooperation towards the delivery of telecom infrastructure. Apart from corporatization, management contracts and Public-Private Joint ventures mentioned earlier, other prominent reforms were corporatization, privatization (Full and Partial), divestitures, market liberalization/de-monopolization and concessions (Støvring, 2004) (Williams & Kwofie, 2014). This phase of telecom reform has been regarded as the policy implementation stage of the reforms which is believed to have begun globally in 1998 when 69 countries committed themselves to the implementation of market liberalization at various future spaces of time (Melody W. , 1999). The call for market reforms was more on the call for private financing to develop public infrastructure (Hearne, 2009) (Jamali, 2004) (Ghobadian, O'Regan, Gallear, & Viney, 2004). In this section, these issues will be discussed. The types of PPIs that will be discussed in this section will be Privatization/divestitures and market liberalization.

3.4.3.1 Privatization

Privatization involves the transfer in ownership of an entity or asset from the public sector to the private sector (Syu, 1995). In some countries such as Malaysia, Nigeria, among others, corporatization preceded privatization. Some countries such as Cote d' Ivoire did not embark on corporatization exercises before privatizing their national monopoly (Mustafa, Laidlaw, & Brand, 1997). However, the discussion on privatization will be split into two sub- sections. In the first sub-section, the discussion will bother on corporatization and why some forms of corporatization is sometimes seen as a form of PPI. In the second section, a brief historical look a privatization, forms and methods Privatization is discussed.

Pre - Privatization

Corporatization

Corporatization involves turning government-owned organizations and agencies into corporations. Corporatization in some cases are organized in the a joint stock company (Hodge & Greve, 2007). Hodge & Greve (2007), identified joint stock companies as PPPs based on financial and organizational relationships. Although joint stock public owned companies may be identified as PPPs based on financial and organizational arrangements, it will not be correct to label corporatization as a PPI. The reason joint-stock companies are regarded as PPIs is due to the fact that the public sector facilitates a partial share divestiture to the public to raise funds in order to facilitate telecom infrastructure development.

A brief overview corporatization

At the advent of the privatization of public utility in most countries, in the 1980s and 1990s, some countries decided to corporatize their then telecom network monopolies. Corporatization is believed as efforts to make state owned enterprises operate as if they were private firms (Shirley, 1999). Corporatization also created a structural separation of the operational and regulatory functions of some national monopolies (Wellenius & Stern, 1994). Corporatization were prevalent during the policy development phase of telecom reforms as countries were developing papers, preparing legislation and creating new regulatory agencies aimed at new telecom reforms (Melody W. , 1999) (Mustafa, Laidlaw, & Brand, 1997).it was the prelude to privatization exercises.

Corporatizations in most cases were facilitated by granting operational autonomy to the entity and the listing of the monopoly in the capital market. Here the corporation would have shareholders and board of directors. In some countries the corporation was still controlled by the state by virtue of the majority shareholdings and management control. A few examples of corporatization as a PPI are mentioned in the box below.

Box 3- 4 Examples of Corporatizations identified as PPIs

Corporatization in Asia: In Asia, countries such as Vietnam and China corporatized by introducing shareholding enterprise systems to raise capital (Yeo & Painter, 2011). In the case of the 2 countries, the state had management control over the state owned companies, Corporatization was seen as an alternative to privatization, corporatization here was adopted to enhance efficiency of the monopoly and telecom was still viewed as Public utility (Yeo & Painter, 2011). In Malaysia, the need to corporatize was to raise funds to meet the growing capital requirements of Syarikat Telkom Malaysia (Wellenius & Stern, 1994).

Corporatization in Africa: In Africa, Ghana, Senegal and Nigeria are examples of countries that did embark on the corporatization of their national monopolies. In 1985, Senegal and Nigeria, their national monopolies SONATEL and NITEL were corporatized (Mustafa, Laidlaw, & Brand, 1997). The difference in their effort laid on the fact that SONATEL secured managerial autonomy, while in the Nigerian case, there was no management autonomy as the management was controlled by the Government. Full management autonomy came in 1992 when the company was commercialized (Ajayi, Salawu, & Raji, 1999).

In Europe corporatization occurred in France in 1990.

Although corporatization as mentioned earlier could be used to make raise money for public infrastructure development, the owner of the infrastructure was the public sector; the private sector only did manage the infrastructure. Under market reforms, the infrastructure is in some cases developed and owned by the private sector.

Discussion on Privatization

In this section, the following topics are discussed. This includes an overview on privatization, forms of privatization, privatization methods, and privatization strategies.

<u>Overview of Privatization</u>

The practice of privatization is not new as it is believed to have dated back to Ancient Greece, the Roman Empire and ancient China among others, where public services were contracted out to individuals or the private sector (Megginson & Netter, 2003) .

The call for privatization was believed to have been widespread in the 1980's as a form of ownership reform and the widespread adoption of privatization occurred in the 1990s (Vickers & Yarrow, 1991). However Megginson & Netter (2003) argue that the one cannot overlook the fact that the defining moment for privatization as we know today resulted from the great depression and the two world wars. At this period of history the depression was seen as the failure of capitalism calling for the welfare state in Europe. They further narrated that the non-efficiency of the welfare states, as a result of resource redistribution raised the arguments for privatization. Megginson, Narsh & Randenborgh (1994) identifies the advent of modern privatization to the Konrad Adenauer regime in the then Federal Republic of Germany in 1957 , where majority stakes of Volkswagen were sold to the public. One would say that one argument complements the other in this case.

Privatization involves the transfer in ownership of an entity or asset from the public sector to the private sector (Syu, 1995). From another point of view privatization could be defined as the use of the private sector to achieve public sector goals (Greene, 1996). From another point of view, it could be viewed as the outright selling of public assets (knieps, 2003). From a broader point of view, privatization as any action that increases the role of the private sector in the economy (Zahra, Ireland, Gutierrez, & Hitt, 2000). There are many other ways the concept of privatization could be viewed. It is believed that privatization could be viewed from at least 15 different ways from Thiemeyer's count (Chai, 2003). Chai (2003) identifies Thiemeyers count as broad views towards the concept of privatization. He identified more narrow perspectives in literature and grouped them into three namely:

- The absolute sale of public assets, excluding other forms of transfer like contracting out and leasing.
- The focus on public assets, excluding collective properties.
- The exclusion of the agricultural sector in the discussion. This he eventually did in his discussion.

Source (Chai, 2003).

These concepts of privatization are derived from various forms and method of privatization in practice. In the next part of this discussion, an attempt is made to identify some forms, methods and strategies towards privatization.

Forms of Privatization

This section discusses the types or forms of privatization. There is no consensus on the forms of privatization. Privatization has been identified in different forms.

Greene (1996) identifies privatization to range from complete government hands off of public utility production to simple contracting. He further concurs that the concept of privatization is broad and includes activities such as deregulation, tax reduction, voucher systems and public divestitures of government properties. Jackson and Price (1994) broaden the list to include: Subsidy provision, the introduction of user charges, Joint public/private capital projects and some other suggestions include the ones mentioned by Greene (1996) (Jackson & Price, 1994).

Vicker and Yarrow (1991), identifies the transfer of public firm operating in competitive markets, the transfer of state - owned monopolies to the private sector and the contracting out of publicly financed services to the private sector (Vickers & Yarrow, 1991). They posit that the public sector retains the right to control via regulation. Zahra et al (2000) stretches the forms of privatization, further by indicating that privatization is not the change of ownership which results in governance and control systems of a public firm because the change could occur in several ways. Rather, it is the change in governance and control systems that determine what form of ownership will emerge as a result (Zahra, Ireland, Gutierrez, & Hitt, 2000). They further argued that change process determines the appropriation of profits and ownership rights. They identified 4 ownership rights of a single firm, 2 by the private sector and 2 by the public sector.

The public sector ownership rights include:

- Pure public ownership

- Partial public ownership where the public owns the decision rights and majority share, which are appropriated on its behalf by the private sector. An example, could be a franchise or regulated firms

The private sector ownership rights include:

- Non-profit private organizations whose profit appropriation is aimed at providing a Public good

- Purely enterprise private ownership.

They argued further that different forms of privatizations could occur between the Public and the Private sector based on these existing ownership structures. However, they called for more study on these forms.

One would say that the discussion on the forms of privatization would continue as there are some scholars that view Public-Private Partnerships as extended privatization (Jamali, 2004).

However, in the development of telecommunication infrastructure, there has not been any major disagreement on what privatization is. It has generally been seen as the transfer of public telecom monopolies to the private sector. The transfer in this case involves control rights and residual cash flow to the private owners2. It is sometimes referred to as either denationalization or de-monopolization (See (Bauer, 1999) (Megginson, Nash, & Randenborg, 1994)). Privatization in the telecommunications sector was adopted in a not so rapid rate[2]. In 1980, 2% of the telecom operators in 167 countries were privatized. This number grew to 42% in 19982.

Privatization Methods

This section discusses the various ways by which privatization is carried out. Megginson & Netter (2001) and Brada (1996) identifies three methods of privatization namely, privatization through the sale of state property, mass or voucher privatization and privatization by restitution and privatization from below (Brada, 1996) (Megginson & Netter, 2001).

Privatization through the Sale of State Property: Megginson & Netter (2001) states that Privatization through the sale of state property (asset privatization) occurs in two forms namely, share issue privatization and asset sale privatization.

1. *Share Issue Privatization:* In this case the public sector sells their controlling shares to the general public. These are often partial privatization initiatives. Examples of share issue privatization are mentioned in the box below.

Box 3- 5 Examples of Share Issue Privatization

The privatization of British Telecom in 1984 where 50.2% of Government interest was sold to the general public (Megginson, Nash, & Randenborg, 1994).

The Partial privatization of Nippon Telegraph & Telephone (NTT) where 54.1 percent shares were sold to the general public (Anchordoguy, 2005).

In Australia, the National Monopoly, Telstra also underwent 3 phases of share issue privatization, where 33% (1997), further 16.6% (1999) and additional 31% (2006) of the Public shares were sold to the general public and investors (Telstra, 2014).

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[2] Li, Wei & Xu Lixin Colin (2002), The Impact of Privatization and competition in the telecommunications sector around the world. http://faculty.darden.virginia.edu/liw/papers/Impact_of_Privatization.pdf

Aside these few examples, it is important to note that this was the initial common form of privatization in various economic sectors including telecommunications (Megginson, Nash, & Randenborg, 1994) (Megginson & Netter, 2001). This was also common in sub-Saharan Africa (see (Williams & Kwofie, 2014). However, this has been overtaken by the sale of assets. Prior to 1985, privatization initiatives in most sectors of the economy were in Europe and Central Asia. These were share issue privatizations and from 1986 onwards, the trend pointed towards Asset sale privatization (Saffar, 2014). The reason for the initial growth of the share issue privatization was because governments preferred it as it contributed to the growth of the capital market. (Saffar, 2014)

2. *Asset sells Privatization:* In contrast to share issue privatization, asset sale as the name implies, involves the total or partial selling of state owned assets to the private sector (Megginson & Netter, 2001). As mentioned earlier, one would realize that the public sectors are more inclined to selling their assets than to issue shares. This is because of the financial benefit and the certainty reaping a huge return. Some examples of asset sale privatization are represented in the box below.

Box 3- 6 Examples of Asset Sale Privatization

The botched sale of Nigeria's NITEL for $ 1.185 Billion Dollars to Investors International Limited in 2001 (World Bank, 2001).

70% acquisition of the defunct Ghana Telecoms for $ 900 million (Financial Times, 2008).

The acquisition of 50% of Colombia telecoms by Telefonica for USD 289 Million in 2006 (Telefonica, 2006).

The acquisitions were facilitated through a bidding process.

Voucher Privatization: This involves the granting of vouchers to the general populace for which they could use to bid for shares in a company being privatized (Megginson & Netter, 2001). This form of privatization was common in the Eastern European countries in the early days of privatization as they had just emerged from the former Soviet Union (Boycko, Shleifer, & Vishny, 1994) (Yarrow & Jasinski, 1996). The advantage of voucher privatization was from political and economic points of views. The political reason stemmed from weak institutions, hence these governments could not find buyers quickly as potential investors were not sure if the existing institutions were strong enough to sustain a privatization process (Gulger, Ivanova, & Zechner, 2014). From an economic point of view, the fear of creating large scale unemployment as a result of privatization led to public institutions granting workers shares in the enterprise to protect their future (Aliu, 2014). In Russia, the workers and managers of the National Telecom monopoly were granted 35% shares of the monopoly (Levy & Buell, 1999). Voucher privatization is not popular these days and rare.

1. *Privatization from below:* This means the allowance given to the growth of private enterprise in areas that were previously serviced by the government (Yarrow & Jasinski, 1996). This is prevalent today as liberalization has led to the growth and expansion of new private players in the telecoms market.

2. *Privatization by restitution:* This involves the return of previously private enterprises which were nationalized back to the original owners (Megginson & Netter, 2001). This is very rare in telecommunications

Privatization Strategy

Privatization could be full or partial (Zahra, Ireland, Gutierrez, & Hitt, 2000). Total privatization involves the total handover of managerial control and stakes of a Public firm to the private sector, while partial-privatization involves the partial transfer of some level of ownership or some level of public involvement in its activity to the private sector. Total or partial privatization could take any of the forms listed above. Privatization is regarded as a PPI because the public sector provides governance while the private sector manages and operates the infrastructure.

3.4.3.2 Liberalization

Market liberalization simply refers to the removal or lowering of regulations or restrictions with the purpose of creating a competitive market to cater for the government's political, economic and social goals. The process of removing the regulations is referred to as deregulation. In telecommunications market liberalization has been described as degovernmentalization and demonopolization (Bauer, 1999) (Chowdary, 1998). The general rationale (as each country does have personal reasons for market liberalization) for market liberalization has already been highlighted in chapter 2. Based on these rationales, countries around the world embarked on the process of restructuring the telecommunications ecosystem. The west led the way providing experiences by which International Donor Agencies like the World Bank introduced to developing countries and sub-Saharan African countries (Nwakanma, Asiegbu, Eze, & Dibia, 2014). Some of the activities embarked upon as mentioned earlier included corporatization, privatization and the adoption of concessions via management contracts and leases.

Liberalization altered the telecom market structure and organization. Initially the telecoms market was organized in a way where the Government was the regulator and the operator. The market structure then was a monopoly. In the bid to liberalize, the general trend was to reorganize the market by creating a telecom regulator (in some countries these regulators were not sector specific), privatize the national monopoly as well as license new private network operators and services and finally the termination of the incumbent operator’s exclusivity period giving room for a competitive market (Blackman & Srivastava, 2011). This pattern was a general norm, but different countries had different approaches towards telecoms liberalization. The interesting thing about telecom market liberalization is how it led to the development of mobile telephony globally and the almost extinction of fixed line-telephony, especially in sub-Saharan Africa. One would say that today, the discussion is not about fixed line telephony anymore, but on Broadband (fixed and mobile).

Liberalization was aimed at facilitating private investment in the delivery of telecom infrastructure, today as a result of access gaps in rural areas towards, mobile telephony and Broadband, there is now renewed public interest in the development of telecom infrastructure. This will be discussed a bit in the next section.

3.4.4 TYPES OF PPIS TODAY

PPIs today occur in different ways. They evolve based on need and also based on the new public agenda as decided by individual countries. However the new forms of PPIs from today can be grouped into 3 categories namely:

- Public collaboration with Community Based networks
- Public investment into the development of Next Generation Networks
- Public Private Partnerships

<u>PUBLIC COLLABORATION AND COOPERATION WITH COMMUNITY BASED NETWORKS</u>

This is the core of this report. The concept of community based telephone and now Community Broadband networks are not new. It emerged as a result of the need of the people, resulting in bottom-up approaches. Community networks have evolved in two ways. The first is with regards to community computing and the other with regards to telephony or ICT infrastructure development. In this thesis, the emphasis is on telephony and ICT infrastructure development, hence there will be no discussion on community computing.

In the domain of telecom infrastructure development, Community Based Networks aimed at developing ICT infrastructure are autonomous associations of individuals bound by the common resolve to achieve their economic, social and cultural needs and aspiration by developing a democratically managed ICT enterprise (Siochrú &

Girard, 2005). Below are examples of previous telephony community based initiatives and Broadband Community Based initiatives

Previous Telephony Community Based Initiatives: Community Based initiatives are in many cases facilitated by co-ops. Cooperatives are independent agencies or organizations of people who associate voluntarily to meet their common economic, cultural and social needs and goals via jointly owned and democratically controlled enterprise (Viardot, 2013). In the old times it was known as the telephone cooperative and with the commercialization of the Internet, it became known as the telephone and Internet cooperative. This was because these co-ops were set up for the purpose of providing fixed line telephony and the Internet. One of the earliest initiatives w established in Argentina, where cooperatives were formed in the 1960s to facilitate the provision of telephony in areas that the state monopoly could not supply (Siochrú & Girard, 2005) (Finquelievich & Kisilevsky, 2005). Some other few examples of early telephone coops are mentioned in the table below.

Table 3- 3 Early Telephone Coops

Coop/ Country	Year Est*	Initial service	Service Today	Catchment Area	Ownership
Brooke Telecom/ Canada	1911	Telephony	Broadband Internet	Rural areas of Inwood, Alvinston and Watford	Private (non-profit)
CoopTel/ Canada	1944	Telephony	Broadband	Rural and now urban Valcourt	Private (Non-profit)
Adams Telephone Cooperative/ United States	1952	Telephony	Broadband	Initially rural and later urban	Private (Non-Profit)
Pioneer Telephone Coop/ United States	1953	Telephony	Broadband Internet	Rural (Williamette Valley to Central Oregon)	Private (Non-profit)
Rivers Telephone Coop/ United States	1953	Telephony	Broadband Internet, Digital TV Service	Urban/Rural	Private (non-profit)

Source: (Brooke Telecom, 2014) (Cooptel, 2014) (Adams, 2014) (Pioneer Telephone Cooperative, 2014), (3 Rivers, 2014), Est* = established

The table above provides evidence for the existence of telephone coops in The United states and Canada. The timeline runs from the early part of the nineteenth century till the great depression. This table does not present a comprehensive list of all telephone coops in the United States and Canada. However, there are many coops today as well, such as Coop mobil in Denmark (now owned by TDC), the Phone Co-op in the UK etc. (See (Coop Mobile, 2014) (The Phone, 2014)).The formation of telephony coops in the US occurred when the formation of utility coops was the norm. This occurred during the great depression as a form of extending utility to rural areas by individuals in the community (Viardot, 2013). In Canada, the cases were mostly as a result of either the refusal of the existing network operator to supply to the rural area, hence individuals decided to do something about it.

The concept of community based networks, with regards to telecom infrastructure development could be seen in two lights.

- **Networks developed mainly for ICT provision in the community by an external agency**: This is a top to bottom approach as the driver for the change is the vehicle of the Government. An example is a case in India analyzed by Siochrú and Girard (2005) seen in the box 3.7 below.

Box 3- 7 The case of Akshaya India

The Akshaya project was facilitated by the Public Service of the state of Kerala to promote the Universal Access of new ICTs in the state. In India, Villages have self-governing bodies that coordinate the village(s) called Panchayats. The initial idea was for the government to facilitate long distance computer education programmes in the Panchyat, where the state government would fund the infrastructure delivery to an access point (telecentre) and the Panchayats would contribute funds to pay for the education of one person per family as a means of capacity building. The government was to be represented by the IT Missions.

The IT Missions changed their minds and opted for a network of telecentres that would not just provide distance learning but broad ICT possibilities to the populace of the Panchayat. To realize these goals, the IT missions called for applications from the private sector to invest and run the envisaged centres. They were given loan guarantees from the public sector. The IT Mission also partnership with different sectors of the economy to produce contents for these commercial telecentres.

To facilitate community participation, the central government has adopted means such a video conferencing to interact with the people of the villages. In other cases the users pay their utility bills attend remote classes at these missions (Siochrú and Girard (2005)).

- **Networks developed by a community cooperative organization with or without the help of an external agency**: This is a bottom up approach as the driver of change is the community. The examples of community organization with no public help include the aforementioned American experiences where the pioneers sourced for financial and technical expertise among themselves to develop telephony networks privately.

In narrating the cases of community organization with public help, one can identify 2 approaches. The first is in form of cooperation, where the public sector and the private sector share resources to achieve a common goal. The second approach is that of a collaboration where different public and private sector entities contribute resources to achieve a shared goal. An example of the first case is from Poland and an example of the second case is from Argentina. These cases are represented in the boxes below.

Box 3- 8 The Case of Poland

Poland: The network in Poland was facilitated National Telecom Cooperative Association, who persuaded the Polish Government to permit village telephone committees, set up rural telephone systems. In 1989 two cooperatives were formed, WIST and Tyczyn Telecommunication Cooperatives. Tyczyn is a rural area while WIST was in a semi-urban area. The project was financed by USAID (funding was controlled at the office of the Prime Minister). The village committee was a partnership between the village committee and the local Mayors. The initial service provided was telephony and later internet services. The project was partly financed by a North American Company Nortel, the cooperative organized to help in the construction of the lines and buildings. The service was maintained by member subscription. (Source (Siochrú & Girard, 2005)).

Box 3- 9 The Case of Argentina

Argentina: The Argentine case is cited by (Siochrú & Girard, 2005) and (Finquelievich & Kisilevsky, 2005). They mention a cooperative that developed telephony in a remote area in Argentina in the 1960s.

The network in Argentina was located in the city of Pinamar, known for tourism. The Pinamar Telephone Cooperative (Cooperativa Telefónica de Pinamar, TELPIN Ltd). The TELPIN Coop was created in 1962 with 82 residents led by Dr. Susini. In 1963, they were able to independently facilitate telephony to each members home. They installed the first digital lines in Argentina in 1980. By 2004 they had installed 18000 (each line represents each user) lines. Telnet was launched in 1998 after they had developed and Internet backbone. They provided more than 1120 Broadband Connections by 2005. They provide free Broadband service to the Pinamar Schools, Public Library and other community institutions.

The coop is operated by a board voted by the general assembly. The funding of their initiative has been from stakeholder contributions. Their stakeholders ranged from local enterprises to individuals.

However the collaboration came in form of the public sector providing legislation that led to the creation of telephone cooperatives and gave the cooperatives to only provide telephony if the area was regarded as commercially unviable by the state monopoly (ENTEL) (Finquelievich & Kisilevsky, 2005). The legislation also mandated the State monopoly to build switching centres or exchanges for the cooperatives as at when needed (Finquelievich & Kisilevsky, 2005).

Broadband Community Based Networks: In recent times (at the turn of the century) these networks have evolved globally. However, now the emphasis in the development of community networks has shifted from the provision of telephony and basic Internet towards Broadband Networks and Broadband Internet services. The development of Broadband Community Networks has been enabled by the affordability of the terminal equipments and Customer Premise Equipment and the free spectrum requirements for Wi-Fi in some countries around the globe (See (Frangoudis & Polyzos, 2011) (Raman & Chebrolu, 2007)). The possibility of facilitating these fixed or wireless Broadband by communities has now steered up discussions on how more of these networks can be built (see (Flickenger, 2003)). Community Broadband Networks has also been identified as an innovation in the delivery of ICT Services (Oost, Verhaegh, & Oudshoorn, 2007). This has opened up an opportunity for research (see (Salemink & Bosworth, 2014))

Most of these networks exist in The Republic of South Africa, North America, Europe, Asia and South America. The services provided by this community owned networks are mostly wireless Broadband Internet infrastructure with few fixed Broadband internet infrastructure. Unfortunately, these networks are rare in sub-Saharan Africa and the visible cases in this region is that of South Africa, which is more urban oriented than rural.

Aside the United States, Europe has a mix of rural and urban Community Based Broadband initiatives. The European examples are important because, quite unlike the cases in the United States, there are traces of public support towards these networks. An example is that of the DjurslandsNet which will be discussed in this thesis. Examples in Europe include the defunct DjurslandsNet (Denmark), Wireless Leiden (Holland), Freifunk (Germany), Funkfeuer (Austria), The Athens Wireless Metropolitan Network (Greece), Guifi.net (Spain), CzfreeNet.(Czech Republic) and many others not listed here (Oost, Verhaegh, & Oudshoorn, 2007) (Shaffer, 2013).

Table 3- 4 ***List of Wireless Networks in Europe***

	Network	**Country**	**Location**	**Initiator**
1	DjurslandsNet	Denmark	Rural/Sub-urban	Community
2	The Athens Wireless Metropolitan Network	Greece	Urban	Community
3	CzfreeNet	Czech Republic	Urban	Community
4	Freifunk	Germany	Urban	Community
5	Guifi	Spain	Rural	Community

Source (Oost, Verhaegh, & Oudshoorn, 2007) (Shaffer, 2013)

However, most Community Based Broadband Networks began as community Initiatives. Some had minimal or no government support at all. However, in recent years, there has been renewed government interest both from the central government and now from the municipal governments as they are closer to the people (Strover & Mun, 2006). One would say that the abilities demonstrated by the communities have led to the rekindling of municipal interest and actual municipal involvement in the development of Broadband Networks. Earlier in this chapter, mention was made of the involvement of municipalities in the EU towards telephony infrastructure development. Now municipalities in the US such as municipalities in San Francisco and Philadelphia have plans for their own Broadband networks (Picot & Wernick, 2007). Their plan centers on pumping public finance for Broadband infrastructure development (Picot & Wernick, 2007).

The entrance of the municipality in the provision of Broadband infrastructure has been explained by, Sirbu and Gilet (2006) to be as a result of the following factors:

- Market failure, which is as a result of inadequate infrastructure provision by the private sector and the high CAPEX and OPEX in the provision of infrastructure relative to the low revenue accrued by the investor.

- The assumption of the Local Government's role in providing ICT infrastructure. In this case the municipality views telecom infrastructure as an essential service (See also (Strover & Mun, 2006) (Tapia, Maitland, & Stone, 2006)).

- The opportunity to take advantage of either economics of scale or economics of scope made possible by investments or services that exist for other reasons. Sirbu and Gilet (2006) explains that, in this case the municipality may be involved in another project such as electricity, government buildings and they see ICT as a means of operating a coordinated meter reading or connecting government buildings to enable easy and timely transfer of information. Hence, from the municipality's point of view, the more ICT is used for more governmental services as well s the potential growth of citizen adoption, the cheaper the cost of ICTs will be on the long run. From the economics of scale point of view, as ICTs act as enablers and aids in efficient service delivery, the cost on the long run by providing the government service will be reduced as the cost of maintaining the ICT infrastructure reduces. Hence, in this manner the Municipality has the incentive to invest in ICT infrastructure to help reduce the CAPEX and OPEX of the private network operator.

- Tapia, Maitland & Stone (2006), summarized this point by mentioning that the municipality's incentives rides on the fact that they intend to reduce the cost they incur in the delivery Broadband to their citizens. Hence the municipality plays the role of both the supplier and consumer of Broadband.

Strover and Mun (2006) identified other rational for municipal interest in the provision of ICTs to include the need to facilitate affordable and widespread ICTs in their domain

In the EU, in the case of Italy and Netherlands, the municipality's involvement was based on the fact that the Incumbents did not see the prospects of NGNs in rural areas, there was demand for NGNs in these rural areas and NGNs are seen by the public sector as a means of bridging the digital divide (Nucciarellia, Sadowski, & Achard, 2010)

However, this rekindled desire from municipalities stems from the fact that it is now easy for community Broadband coops to deploy Broadband wireless solutions, such as Wi-Fi or WiMAX (Strover & Mun, 2006) (Tapia, Maitland, & Stone, 2006). Secondly, the growth forecast of future Broadband users makes the municipal investment in fiber optic infrastructure desirable (Lehr, Sirbu, & Gillett, 2006). Hence, in a nutshell, one would say that the possibility of supply interventions plays a role in the municipal investment in Broadband infrastructure facilitated by Broadband coops. However, in passing it is important to note that the involvement of the municipality in the provision of Broadband has not been without misunderstandings as they are often seen as unfair competitors to the private network operations (i.e., if the municipality owns the network in question) (See (Strover & Mun, 2006) (Powell & Shade, 2006)).

Hence the municipality involvement in the facilitation of Broadband Infrastructure with Broadband coops can be seen as PPIs. An example of such a case is the Almhult municipality Broadband Initiative, used as one of the cases in this report.

PUBLIC INVESTMENT INTO THE DEVELOPMENT OF NEXT GENERATION NETWORKS

Earlier in this chapter, there were examples of Public investment in telecommunications at different era of telecom technology innovation. These ‘new’ approach to telecom infrastructure development is termed PPI as the public sector is now involved in telecom infrastructure development which for some time now has been a private initiative (Gómez-Barroso & Feijóo, 2010). However, this report has proven that this approach is not new. However, the newness now centers on the telecom technology being promoted and why they are promoting it. One would call it an ‘*Old wine in a new bottle*’. Also, as seen in the previous section, there is now more involvement of municipal councils in the development of Broadband infrastructure with Broadband coops. Public involvement in Broadband and NGNs has not been without opposition as the Private sector in the US sees it as unfair as the government is not a profit making entity (Lehr, Sirbu, & Gillett, 2006). Secondly, network operators do not buy the idea that telecommunications are still a public good (Strover & Mun, 2006). Still in the US, some states do prohibit public or state agencies from owing utility, which is quite the contrary in Canada (Powell & Shade, 2006) (Strover & Mun, 2006). However, in the EU, public investment in the delivery of Broadband is only welcomed if it serves as a compliment and not a competitive gesture to private sector efforts (Strover & Mun, 2006) (Europa, 2006).

Gomez-Barroso & Feijoo (2010) cited other challenges to include lack of clarity of public goals for investing in NGNs which includes the level of investment needed by the public sector to leverage private investment; how fiber optics will be extended to the underserved areas and what are the expected results of the local initiatives that are considered beneficial (Gómez-Barroso & Feijóo, 2010).

But despite these challenges, there has been renewed public investment in Broadband and Next Generation Networks (NGNs). This vim in public investment is anchored on the perceived value of Broadband and NGN networks to the socioeconomic and political dynamics of the society (Nucciarellia, Sadowski, & Achard, 2010) and the impact of the financial crises of 2008 which indicated that private sector investment alone could be hampered by the health of the economy, hence public investment had to be revived in funding Broadband (Given, 2010). Hence public sector experience on the inability to achieve equity in the distribution of telecom services, enhanced by liberalization has led to the Public Sectors attempt to aid in the bridging of Broadband and NGN infrastructure deficit. One would not also write off the potential long term supply side effect towards the delivery of Broadband and NGNs when demand for Broadband services take off (Given, 2010).

The investment dimension has been facilitated by policies aimed at facilitating social inclusion, demand aggregation (pooling demand for Broadband within a state or region) and the provision of subsidies by the public sector to private sector investment in telecommunications (Gómez-Barroso & Feijóo, 2010).

Public investment has occurred in two ways, the first is by direct financing actions and the second by indirect financing actions.

Direct Public Financing: This discussion is not about infrastructure financing which involves different forms of financing infrastructure delivery, such as privatization, etc. This discussion involves the actual financial contribution from the public sector in the development of Broadband via, partnerships, subsidies, grants and loans. From the partnership point of view, most investments have been in the form of Public Private Partnerships. This form of PPP (Private DBO) will be discussed in the next chapter.

However, in Europe and North America, in recent times, governments have made plans for huge investment into the development of Broadband and NGNs using stimulus packages (Qiang, 2010). These stimulus packages were designed to accommodate different partnerships with the private sector towards the development of Broadband. Examples of some direct actions can be seen in the table below.

Table 3- 5 Examples of Direct Financing of Broadband Networks

	Country/Region	Stimulus amount ($US)	Financing approach	Year of inception
1	Australia	30 Billion	PPP	2009
2	Canada	181 Million	3 year subsidy towards underserved areas (Private DBO)	2009
3	Spain	118Million	PPP	2008
4	EU	1.3 Billion	Loans and grants	2008
5	Singapore	650 Million	Grants (Private DBO)	2009
6	US	7.2 Billion	Grants, (Private DBO)	2009

Source: (Qiang, 2010), (Europa, 2006) (Avanza plan 2, 2014)

Finland and Spain are examples of beneficiaries of the EU funding as an augmentation to their funding towards rural NGNs (Qiang, 2010).

The approaches to direct financing vary around the world. The cases mentioned in the table above are mostly FTTH related projects. They are also aimed at funding high capacity Broadband networks or NGNs. However, in Sub-Saharan Africa, the investment focus is neither towards the rural areas as such, not last mile Broadband development. Rather the development initiatives are focused on the development of national bandwidths. It is difficult to call these direct funding initiatives PPIs. This is because this national infrastructure development has been either a pure public or private effort.

However, in the context of direct infrastructure financing of international Broadband Bandwidth, there are examples of PPIs. Examples include the multinational Eassy project (at inception) and the Kenyan Teams International Bandwidth project (Williams & Falch, 2012). In both cases the public agencies involved provided the regulatory framework that facilitated the project, they were also members of Special Purpose Vehicles (SPVs) that would finance and manage the project and they had equity in the SPV that would manage the project. In the case of Kenya, they have been selling off their shares gradually.

Indirect Public financing: Indirect financing approaches are varied approaches that do not entail the direct commitment of financing to the development of the Broadband infrastructure either at the international bandwidth, back haul or last mile. These include demand aggregation (Pooling demand for telecommunications in a region or sector), provision of market incentives to network operators and other actors in the value chain, defining market rules (such as encouraging open access) etc. (Gómez-Barroso & Feijóo, 2010). (Qiang, 2010) (Kushida, 2013). Interestingly it also includes re-nationalization of former national monopolies, as in the case of Brazil. Here the Brazilian state own more than 80% stake in the company and the public sector utilizes Telebras for the development of Broadband Infrastructure, as Telebras is mandated to operate as a whole operator (Jensen, 2011). However to encourage new entrants toward the development of Broadband, the Municipalities and the central government offer tax incentives to the telecom/network suppliers and facilitate the provision of national fiber optic backhaul by providing R70 Million between 2010 and 2014 (Jensen, 2011).

- Demand aggregation: Demand aggregation has been aimed at encouraging the usefulness of the cyberspace for everyday activity. In Denmark, for example, it is now mandatory to file tax returns via the internet. Still in Denmark, some municipality functions are now automated as a way of encouraging e-government. Digital public services are also being developed in Spain as a way of encouraging demand for Broadband (Avanza plan 2, 2014). The other case is the move towards a cashless society among others. Demand is also aggregated via IT training of the citizen, some examples are Spain and South Korea (Avanza plan 2, 2014) (Qiang, 2010).

- Defining market rules: In the case of defining market rules, aside indirect investments mentioned above, an example is the principle of facilitating open access to fiber optic infrastructure by a competing operator. To avoid exclusion in the transnational supply of fiber optic bandwidth, the network operators of the participating African Nations with stakes in the EaSSY project were mandated to provide open network access to competing operators who were not part of the consortium. This regulation was made by the New Partnership for African Development (NEPAD),- the development arm of the African Union (Ojione, 2013).

- Market Incentive: A case of market incentive is the case of Japan, where remote Broadband infrastructure was facilitated by guaranteeing proving loan guarantees, tax breaks and loans at low interest rate to enable the private sector develop Broadband infrastructure in rural areas (Kushida, 2013). In the US, loan guarantees are provided for suppliers who intend to provide Broadband infrastructure in rural areas (Qiang, 2010).

Before moving to the next point on PPP's it is important to point out here that the discussion on PPI is murky and it runs through a fine thread. What makes this so is because once the fine thread does not exist. Then the public and private sectors would still exist, they would still carry out their activities but will not possess any form of contract, common goals or shared goals. But as it is not, 'the puppet master' is the public sector and although the private sector could do its bidding, it does not have to fall out with the public sector that holds the whip. And finally at this point, it is important to note that whether the public sector decides to use its whip or not is immaterial.

PUBLIC-PRIVATE PARTNERSHIPS

This is a concept in which the rationale for regarding it as a PPI is self explanatory. This is because PPPs cannot be said to have occurred without some form of contractual agreements between the Public and the private sector to develop a particular project or infrastructure. With PPPs the risk, is borne by the private sector and the responsibility for the delivery of the public infrastructure is shared between both sectors as stipulated in the contract (Gray, Hall, & Pollard, 2010). This form of contracting differs from service contracts, management contracts and lease contracts where the public sector owns the capital investment as well as the asset, thereby owning the risk (CEPA, 2010). Another difference between PPP and other forms of partnerships is that the Key Performance Indicators (KPI) for a project are predetermined; hence the success or failure of the project is not based on the final outcome as such but on whether the KPIs have been achieved (CEPA, 2010). Initially the PPP concept centered on the need for private capital in developing public infrastructure, while the infrastructure is jointly owned for the duration of the contract or concessions (Hearne, 2009). These were mostly Public Finance Initiatives (PFIs), Build-Own-Operate contracts and other forms of concessional arrangements. Today, after the development of a market economy in most global markets, most utility infrastructure is privately owned, hence PPPs practiced today also involves the investment of public finance in the development or expansion of utility regarded as public goods or an essential facility (see (Yardley, 2012)). In the next chapter the concept of PPP is discussed fully.

In the development of Broadband, PPPs have been adopted as an infrastructure investment instrument for developing international Bandwidth, national backhauls and the Access networks or last mile. Yardley (2012) did conduct an analysis of how PPPs could help facilitate the Universal Service of Broadband. In the course of his analysis, he mentioned some PPP initiatives in the development of Broadband. In the previous section, some PPPs in the west were mentioned, the selected examples of Broadband infrastructure using PPP will be from non-western countries. Some of the examples are listed in the table below.

Table 3- 6 Examples of PPP aimed at Broadband Infrastructure Development

Country	PPP Project	Cost (US$M)	Form of Investment	PPP Arrangement	Bandwidth
Kenya	TEAMS	130	Equity funding	Joint venture	International fibre optics
Eastern and South African countries	Eassy	248	Equity funding	PFI-DBFO	International Fibre optics
Singapore	Nationwide NGN Network	2 Billion	Public co-financing with universality funds and external funding	Private -DBO	National and last mile (FTTH) and Fiber to Anywhere
Brazil	Brazil Broadband Plan	R 70 Billion	Public grants	Private-DBO	National Fibre optics
Argentina	Argentina connect	1.844 Billion	Public co-financing with grants	Public-DBO	National Fibre optics
Pakistan	Universal Service	PKR 6.2 Billion	Public co-financing with grants	Public Outsourcing	National (FTTH)

Source: (Yardley, 2012) (Williams & Falch, 2014) (Jensen, 2011)

Williams and Falch (2014) retraced some of his steps, not in the same line of discussion however and realized a pattern. As one could see from the table above, in Africa, PPPs in the development of national bandwidth are rare, but not nonexistent, as they are either pure private sector initiatives or public sector initiatives. In the EU and parts of Asia, PPP Broadband investments are aimed towards the development of the whole National Broadband infrastructure ecosystem, from the backhaul to the curb. In South America, PPPs aimed at fixed Broadband as seen in the table above are aimed at developing the national backhaul, wireless and DSL (fixed Broadband) are preferred in these regions, especially in their rural areas (Yardley, 2012) (Jensen, 2011) .

3.5 RATIONALE FOR IDENTIFYING THESE CONCEPTS AS PPIS

In this section the rationale for identifying the concepts of PPI in each era is explained.

3.5.1 TYPES OF PPIS DURING THE EARLY TELEGRAPH AND TELEPHONE DEVELOPMENT

The table below identifies the public responsibilities of the public and private sector in the development of the telegraph infrastructure. This identification of sectoral responsibilities implies that these initiatives were PPIs.

Table 3- 7 Types of PPIs during the Early Telegragh and Telephone Development

	Type of PPI	**Public responsibility**	**Private responsibility**
1	Partnership via Governance	Public regulation and policy	Telegraph Infrastructure ownership, development and management
2	Public funding of Private Network Initiatives	Public financing via subsidy and grants	Telegraph infrastructure ownership, development and management
3	Complementary and competing Infrastructure networks	Public infrastructure development	Private infrastructure Development

Source (Williams 2015)

It is contentious to identify the complementary and competing infrastructure networks as PPIs. This is because these are parallel initiatives. However, both initiatives were geared towards Universal Access. Although parallel, the central purpose, though conflicting, makes it a very weak PPI.

3.5.2 TYPES OF PPIS DURING MONOPOLY ERA

One would say that, beside service contracting, the other forms of cooperation such as management, contracting; Collaboration such as regulation; and partnership, such as joint ventures were preludes to seeking and adopting market reforms. However, China and Vietnam still practice corporatization (Yeo & Painter, 2011). These initiatives, as mentioned earlier in this chapter involve some form of public-private responsibility sharing, either at the project development level (contracting, joint ventures) or at the sector development level (regulation). This implies that these examples are PPIs.

3.5.3 TYPES OF PPIS AT THE DAWN OF MARKET REFORMS

In the previous section, privatization and market liberalization were identified as PPI initiatives. In this section, the rationale for identifying these initiatives as PPIs is explained.

WHY PRIVATIZATION IS CONSIDERED PPI

Having made an attempt to describe privatization, the question here is how is it a PPI? It has been argued that privatization- especially when it is total – has not government control or ownership (CDIAC, 2007). The argument here is that there is no interference in the way the company is managed and the services they deliver. The crux of the argument lies on four factors (CDIAC, 2007):

- Definition of privatization implying a shift of functions and responsibilities from the public to the private sector.
- The ownership implying private ownership.
- Contract structure implying that the firms contract has resulted in private ownership.
- Risk implying that the public sector takes the risk.

This analogy is valid if one is accessing the arrangement from the intrinsic outlook on ownership and purpose. If one would take a look at the extrinsic outlook of the larger network, one would realize that the privatized firm does not exist in isolation and that it has limitations imposed on it by the public sector. Secondly the privatized firm has to achieve two goals. These are the firms' intrinsic and extrinsic goals. The firms' intrinsic goal is to make profit and remain competitive. The firm's extrinsic goals are to abide the regulations and the obligations imposed by the regulation, else the privatized firms, in theory, could lose its privileged.

Hence, if one has to take a look at the interplay here, one would not just assess it from the intrinsic point of view of what the firm becomes but from the extrinsic point of view of why does the public sector allow the private sector to operate in its space.

Hence, from the extrinsic point of view, the public sector sets the goals and organizes the framework needed to develop telecom infrastructure. To make sure the goals are kept and the framework adhered to, the private sector sets up regulation. One could identify the resource sharing in two levels with regards to total privatization. The first is at the cooperative level and the second is on the collaborative level. This is explained in the table below.

Table 3- 8 ***Levels of collaborations with PPIs***

	Level of resource sharing	Explanation on resource sharing
1	Cooperative level	Regulation becomes the contract in the dealing between the public and the Private sector. The private sector's resource to the cooperation is its expertise. The intersecting common purpose for both sectors is the development of telecom infrastructure.
2	Collaborative level	Previous telecom licenses which came with privatization as well had components of universal service. The operators had to prove how much they would invest to extend connectivity. At this point, one would say that the Public sector and the potential private telecom operators had shared goals. The Public sector had to do the screening at the pre-bidding stage either via public tender or other means to decipher if the potential private buyer of the monopoly would be able to achieve public objectives. If they are satisfied, then they would proceed. From a theoretical stand-point, one would say that the interested private sector participant was willing to achieve the public stated objectives before applying.

Source (Williams (2015))

Based on this two analogy, one would say that full privatization consists of collaboration and cooperation between the public and the private sector. Hence it could be called a PPI. Partial privatization is a PPI as there is a little more direct government involvement than in total privatizations. Based on the examples given for each form of Privatization, one could see different forms of collaborations and cooperation.

WHY LIBERALIZATION IS CONSIDERED PPI

The reasons for considering Liberalization as PPI are not too far apart from the reasons given for privatization as being a PPI. This is because for their common PPI characteristic intersects at the extrinsic relationships between the public and the private sectors towards developing telecom infrastructure. However, there are some few characteristics that portray liberalization as a PPI. These characteristics are represented in the table below.

Table 3- 9 ***Characteristics of PPIs***

	Characteristics of PPIs	**Explanation**
1	Relationship to achieve common goals	Here the Government allows regulation to fizzle out as the companies are regulated by the market, but the Government becomes ‘the umpire of the game’ (provides governance and guidelines) to ensure that the goals achieved by the Private sector are publicly desired goals. To facilitate connectivity in rural areas, the public sector in South American countries has provided regulatory incentives such as license free spectrum and no telecom license the private sector to invest in wireless networks of their choice (Townsend & Stern, 2006). Here, the overall goal is Universal access and the role of the public sector is governance and the role of the private sector is to invest in infrastructure.
2	Collaboration on infrastructure development	The second point of intersection lies in the development of telecommunication infrastructure in private sector usage as a way of ensuring Universal Service. In most African countries such as Ghana, and Asian countries such as Singapore, the national Governments have invested heavily in the development national fiber optics backhauls to facilitate private sector usage for the delivery of telecommunication services (Williams & Falch, 2014).
3	Collaboration to develop regional telecom companies	In some rural areas, setting up telecom networks, even in a liberalized market, has not been enticing. In this case the Public adopts the usage of Universality funds to support privately initiated regional telecom companies. The Peruvian government is an example of a public sector that adopted such an initiative. An example of such a case is the Valtron Rural Telecommunications Pilot Project (Townsend & Stern, 2006).
4	Collaboration in the development of ICT services	One of the major changes that came with liberalization was the new approach to Universal Access and Service. This involved the downstream facilitation of ICT services. This was done by means of using Universality funds to aid in the development of commercial telecenters (Townsend & Stern, 2006).

Hence, one could see with liberalization, there were forms of cooperation and collaboration between the public and the private sector to develop ICT infrastructure in rural areas.

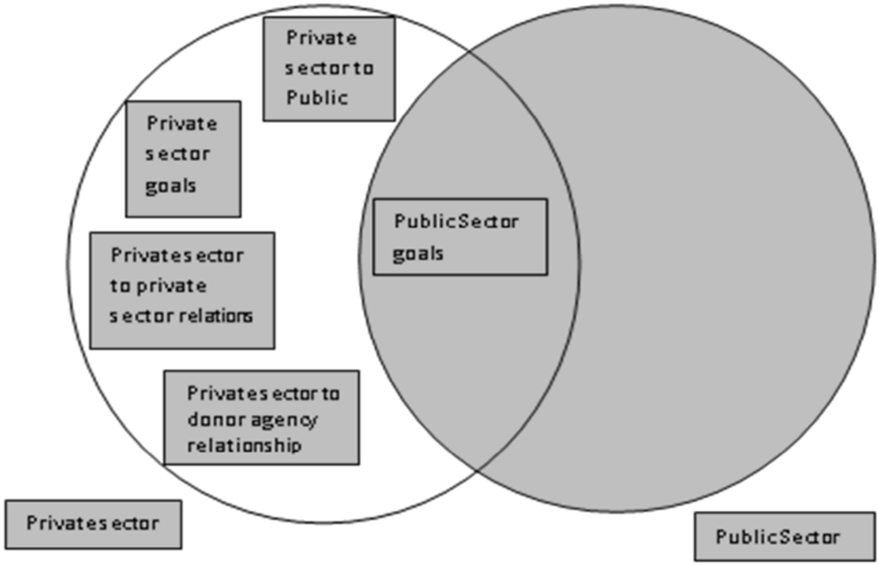

Figure 3- 2 Intrinsic and extrinsic Public - Private Relationship

As seen in the figure above, one could see that telecom infrastructure can be developed via direct private sector to private sector relationship. It could be a cooperation, collaboration or merger. Telecom infrastructure can be developed into a relationship between the private sector and a donor agency. Aside telecom infrastructure development, the private has its goal of gaining Return on Investment as well as its relationship to the subscriber via branding, customer service, etc. These are all forms of collaborations and cooperation that are in the interest of the private sector, but they are not PPIs. A PPI occurs in a liberalized environment when the private sector participants contract (agree) with the public sector via licensing to do the public sector’s bidding.

3.5.4 TYPES OF PPIS TODAY

In the previous section, Broadband Community Networks, Public investment into the development of Broadband and Public-Private Partnerships are identified as PPIs. In this section, the rationale for identifying these initiatives as PPIs is explained.

BROADBAND COMMUNITY NETWORKS

Having given this overview, the next question would be, how are community based networks PPIs. Before proceeding, it is important to note that Community-Based networks are not necessarily PPIs, but when the organization or financing or both involves some form of Public-Private cooperation, then it is a PPI. To identify some PPIs, the phenomenon of Community Based Networks will be assessed in 2 ways.

- Community Based networks involving municipalities

- Community Based networks not involving municipalities

Community Based Networks involving Municipalities: Lehr, Sirbu and Gilet (2006) identify four ways in which Municipalities could be involved in Broadband Infrastructure development. This includes (Lehr, Sirbu, & Gillett, 2006):

- The retail service model: The municipality rents out its infrastructure and services to consumers.

- The wholesale Service model: The municipality owns and operates the Local Access network.

- The franchise model: The municipality contracts with a private firm to build and operate the network

- The real estate model: The municipality provides access to the right of way

- The Coordination model: The municipality provides a standard for demand aggregation

These examples are not pure public sector initiatives. In the first examples, the retail service, the infrastructure is owned by the municipality, while the private sector operates the service. In the second case the municipality owns and operates the local access network, mostly a fiber optic network, while the network operator (the private sector) provides the last mile services. In the third case, the municipality's role is that of a facilitator, while the private sector is free to build and operate a network using the municipality's guidelines. Finally the coordination model consists of the same cooperation as the fourth example.

This cooperation makes the community based networks involving municipalities PPIs.

Community Based Networks not involving Municipalities: These are actually community based networks involving non-profit organizations or cooperatives. These groups stem up from collective interest in Broadband and they are mostly loosely organized, decentralized and informal in their approach to Broadband infrastructure delivery (Powell & Shade, 2006). Powell and Shade (2006) also point out that some of the members could be technology professionals or just interested amateurs. The aim of community interest in the provision of Broadband can be summarized as that of providing free or low-cost wireless Broadband access (Tapia, Maitland, & Stone, 2006).

Examples of such coops are listed in the previous table. As mentioned earlier, not all of them could be deemed PPIs especially if there is no form of public involvement. In South Africa, you have Johannesburg Area Wireless User Group (A case for this thesis), Cape Town Wireless User Group and a few others in South Africa. These are urban community based networks (Wireless User Groups, 2014). In Canada, examples include Ile San Fil, BC Wireless network society, (Powell & Shade, 2006). In the United States, examples include The Magnolia road Internet Coop (A case in this thesis), and a lot of others.

One cannot say that there is a direct partnership, collaboration or cooperation for Coop-based Broadband networks as a result of the public sector providing enabling legislation with regards spectrum and licensing. This is because the aim of such public sector provisions is aimed at profit-making private sector network operator. These are tailor made legislation for the network operators and not for the coops. One would say that the coops in a way explore the regulatory loopholes to operate- making the public sector an indirect collaborator.

Secondly, the goals of the public sector and that of the non-profit organization or the coops are not common, although one would say that the goals are complementary. This is because the big picture for the public sector is national Universal Access and Service whereas the goal for the coop or the nonprofit organization would be village coverage or in some cases sub-urban Universal Access and Service. The coop's goal fits into the national plan, but the coops goal has nothing to do with the national plan but their own plan. In this case, one would not say that there is any form of direct partnership or collaboration but and indirect collaboration as well. But if there are policies aimed at encouraging the coop or non-profit organizations to develop Broadband networks, then one would say that there is a form of collaboration here as the public sector identifies the coops as direct partners.

Having given this background, some forms of PPIs could be identified in the provision of Broadband by community based networks. Examples of collaborations are expressed in the table below.

Table 3- 10 Points of Collaboration in a PPI

	Point of collaboration	**Explanation**
1	Collaboration at the network planning stage	Here the public sector leads the way by proposing the idea for a Broadband Network and the community is engaged in the planning and how the network is integrated in the local community. An example is the case of Canada, where the Public Agency, the National Broadband Task Force proposed the inclusion of communities in the planning of the network and the integration of local capacities (Strover & Mun, 2006). The national Broadband task Force was established by the Canadian Government in 2001 to develop a roadmap for the universal Access of Broadband by 2004 in Canada. In this manner, the Community would feel a sense of belonging and 'ownership' of the network even though it is a government infrastructure.
2	Cooperative wholesale fund raising collaboration	Here, instead of the municipality building the network and renting it out, it partners with local cooperatives to jointly raise funds and resources for the access network deployment (Tapia, Maitland, & Stone, 2006). Another funding possibility here could also be between the coop and the central government (Tapia, Maitland, & Stone, 2006).
3	Network design, development outsourcing	Here the municipality employs the community with the mandate to outsource either or all of the network design, deployment and management to the private sector (Tapia, Maitland, & Stone, 2006).
4	Market wholesale service to ISPs	Another form of collaboration centres around the municipality and the coop jointly providing wholesale services to Internet Service providers and other Broadband service Providers (Tapia, Maitland, & Stone, 2006).

These forms of cooperation among other possible forms are examples or partnerships that could exist between the public and the private sector. It is important to note that the public sector does not necessarily have to be the municipality; it could be the region (county, province or state) or the central government or any of its agencies. The advantage of the cooperation in the public sector and the public sector is the reduced cost of expenditure on investing in Broadband infrastructure development.

Based on the facts cited above, one would say that where there is some form of cooperation, Partnership or collaboration between Community Based networks and the Public sector, this could be termed PPIs.

PUBLIC INVESTMENT IN THE DEVELOPMENT OF BROADBAND

In the realm of direct and indirect public financing in the development of Broadband, it has been established earlier in this section that not all forms of public financing constitute PPIs. However, for public financing to be PPI, there has to be the actual investment of resources on an intrinsic level towards Broadband development. Public finance should form a percentage of the expenditure on infrastructure; however, loans and loan guarantees could not be called PPIs under direct financing. This is because the public sector gets their money back.

However, under indirect financing, one would say that the private sector would have spent much more without the incentives provided by the government. Here the public sector is either collaborating to prompt demand while the private sector focuses on the supply. Alternatively, the public sector is collaborating to ease the flow of supply. On both sides of the coin, one would see an extrinsic relationship between the two parties towards achieving a shared goal. Based on this fact, indirect financing is a PPI.

PUBLIC PRIVATE PARTNERSHIPS

As mentioned earlier in section 3.4.4 the rationale for PPPs being a PPI is evident as the core of PPPs is an interaction between the public and private sectors. More on PPP is discussed in the next chapter.

CHAPTER 4. PUBLIC-PRIVATE PARTNERSHIP

4.0 INTRODUCTION

In this chapter, the discussion will center on defining PPPs, understanding the history of PPPs, the type of PPP arrangements, the rationale for PPP, and a brief summary of the volume of PPP transactions in the development of telecom infrastructure. In this chapter, PPP will be discussed from a broad sectoral point of view. The reason for taking this approach is to have a clearer picture on how PPP institutional arrangements have evolved and why they evolved. This was why this chapter was written separately from the parent chapter on PPI (chapter 3). The aim of the separation of chapter 3 and 4 was not to create a distinction between PPP and PPI. As it was mentioned in chapter 3, PPPs are PPIs. Rather, it is the PPP institutional arrangements from this chapter that provided an inspiration for the development of the Final PPP/PPI model in chapter 11 (section 11.8). The limitation of this chapter is based on the fact that there could be some telecom related PPPs that exist under an institutional arrangement, but was not mentioned because it was not located at the time this report was printed.

4.1 DEFINITIONS OF PPP

PPP is a concept with a broad spectrum of definitions as will be seen a little later. Hodge & Greve (2007) identify two major views towards PPPs. The first view identifies PPP as a governance tool. The second view identifies PPP as an infrastructure tool. This divergence in views is why the concept of Public Private Partnership (PPP) is often used interchangeably with PPIs. The crux of the argument for this confusion is bent on the word partnership. Hence the outlook towards PPPs will be tackled from the word partnership. However, one would say that PPPs are PPIs and not vice versa.

The approach to looking at the definitions can be understood from the point of view the academia and that of the public sector with regards their understanding of partnerships. Earlier in chapter 3, an attempt was made to define the word "partnership". It is important to have that in perspective as an attempt is made to understand other views to the concept of partnerships.

When discussing PPPs, "*Partnership*" is often conceived in different ways. Partnership has been used interchangeably with the words '*collaboration*', '*cooperation*' and '*contractual relationships or arrangements*'. One could see examples both from the Academia and from the way PPP is defined in different countries. From the academic point of view PPP has been described as a collaboration (see (Jamali, 2004)), cooperative arrangements (Borzel & Risse, 2005), Cooperative institutional arrangement, (Hodge & Greve, 2007), Cooperation (Nijkamp, Van der Burch, & Vidigni, 2002),contractual arrangement (CEPA, 2010) (Hart, 2003) (Gray, Hall, & Pollard, 2010) (Hearne, 2009) (Grimsey & Lewis, 2002), and Contractual relationship (Cook J. , 2007).

However, different public agencies aroung the world use more than the concepts of partnerships, collaborations and cooperations to define PPPs. This is evident in table 4.1 below. Still from the public sector perspective, the definition of PPP is divergent. From the public sector point of view, the Government of India has identified 19 definitions of PPP from one regional body (EU), 2 local Indian states (Andhra Pradesh and Gujarat), 4 international development/donor agencies (IMF, Asian Development Bank, European Investment Bank and the OECD) 1 credit rating house (Standards and Poor) and 11 countries (India, UK, US, Australia, Singapore, Canada, Brazil, Portugal, South Africa and Republic of Ireland) (Department of Economic Affairs, 2010).

Table 4- 1 Definitions of partnership from some countries and International Development Agencies

Country/Entity	**Partnership**
Australia	Spectrum of contractual relationships
India	Contractual or concession agreement
UK	Joint working between the Public and private sector
US	Contractual agreement (excluding conventional means of contracting)
Singapore	Long term partnering relationship
Canada	Cooperative venture
Brazil	Contractual agreements
Portugal	Contractual agreements
South Africa	Commercial transaction between the public and private sector
Republic of Ireland	Clear arrangement on shared objectives

European Commission	Co-operation between public authorities and the world of business
IMF	Arrangements where the private sector supplies infrastructure in economic sectors that were initially the prerogative of the public sector
Asian Development Bank	Range of possible relationships
OECD	Any arrangement between the public and private sector to deploy infrastructure
Andhra Pradesh	Concessions
Gujarat	Concessions

Source (Department of Economic Affairs, 2010)

This varied view of partnerships has led to the murkiness and fluffiness that surrounds the PPP concept. This existence of the divergent views on PPP is not new (See (Jamali, 2004) (Weihu, 2006) (Khanom, 2012)). However, despite these divergences, one thing that is not in doubt is that PPP is an institutional arrangement and they are mostly long-term contractual agreements (Grimsey & Lewis, 2002).

One would also agree that - in as much as - there is a sense in calling PPIs as PPPs as the word partnerships, collaboration and cooperation are synonymous; the modern PPP concept was originally well defined within its domain, New Public Management. Its application varies but it is a concept used originally in the context of infrastructure investment (Grimsey & Lewis, 2002). It is important to understand how the partnership is perceived under this domain

4.1.1 PERCEPTION OF PPP PARTNERSHIPS UNDER PUBLIC PROCUREMENT

The use of the word partnership within the public procurement as a form of New Public Management was not envisioned to become a universal word with a divergent forms of possible or synonymous definitions. It was rather a transformation in the way public infrastructure and service procurement was carried out. Infrastructure development is characterized by the design phase, the construction phase, the operation, maintenance, rehabilitation and renovation phases (Hudson, Haas, & Uddin, 1997). From a non - academic point of view, the Cambridge Economic Policy Associates (CEPA) identifies infrastructure development phase to include the design, construction, operations and maintenance

(CEPA, 2010). In the case of public infrastructure development, the planning stage was often carried out by the public sector (Lenferink, Leendertse, Arts, & Tillema, 2014). Initially the public sector had direct supervision over the infrastructure development life cycle and they bore all the risk. The private sector has been the tool to achieving the building, operation or maintenance of the guidelines provided by the public sector, with regards infrastructure development. Their relationship was cemented by contracts to fulfill only one or more of the project sub-life cycles towards infrastructure delivery. One firm could get the contract to design; another could get the contract to construct, etc. At the operation and maintenance stage, the private sector could either contract the private sector via concessions, lease contracts or management contracts (Hart, 2003). Some contracts were either bilateral or unilateral.

However, these contractual agreements were not viewed as partnerships. They were seen as purely public activities, irrespective of how they were carried out. The transformation came into play when the role of the private sector was transformed from, either building ,operating the infrastructure or service for the public service, to having a sense of ownership and control in the projects.

Since the infrastructure was jointly owned in this new form of contracting, this implied that the public sector and the private sector will share responsibilities as well as a certain amount of risks. However, in the early days of creating PPPs in the 1980s and 1990s, risk was shifted to the private sector (Jamali, 2004). But in reality the public sector also bore risks, such as standing as loan guarantees for the private sector partner. The responsibilities rested on the resources and capability of each partner. Some examples of the resources contributed are as follow:

- **Private sector contribution**: The private sector resources included capital, technical expertise (with clearer objectives, fresh ideas, improved infrastructure planning) and their involvement in the bidding for projects would lead them to propose improved incentives that would facilitate competitive tendering and the private sector could evaluate Value for money for the projects (See (Nijkamp, Van der Burch, & Vidigni, 2002) (Spackman, 2002)).

- **Public sector contributions**: The public sector offering included the provision of facilitation, partnership, legal and regulatory assets for the project (Jamali, 2004), This was a shift from direct government involvement as it was in traditional procurement contracts. In other cases the public offering include some form of off-balance sheet financing and some direct financing during the concession period (i.e. if the form of PPP was a concession) (Gray, Hall, & Pollard, 2010). The off-balance sheet financing in this case implies that the government will get back the infrastructure at the end of the concession period as the private sector would have recouped its investment, in which the government would have paid were it to be a traditional form of contracting. In the case of Private Finance Initiatives (PFIs), as the public sector does not own the asset during the concession or contracting period, the public sector pays the private sector committed revenues for the use of the facility as part of the resources it contributes (CEPA, 2010).

This synergic pooling of resources, risk sharing between both parties is what was perceived as a partnership when discussing early PPP, as traditional forms of contracting was transformed as regards infrastructure investment. To buttress this approach of identifying partnership, Jamali (2004) identifies partnership in this context as collaboration between different entities to achieve a common goal, where each party is designated with clear assignments of responsibilities. She proceeds to add that the roles should neither be identical or antagonistic but complementary. The difference between PPP and other PPIs is stated here is that, there is resource dependency and commitment symmetry in with regards PPP projects. In a PPP project, any partner could pull out, if there is a lack of trust, openness, fairness and mutual respect.

Based on this perception, PPP originally was viewed as an extension of public procurement and a new form of Public management. This is why in most of the definitions mentioned earlier; it was viewed as a contractual agreement. However, PPPs have evolved and gradually becoming more and more popular in the development of telecom infrastructure. At this point the concept of partnership also shifts as it will be seen in the next sub-section

4.1.2 PPPS TODAY

The concept of PPP today as seen in the table above is growing in a divergent manner. There has been a shift from the concession and lease based contractual agreements to more divergent views that challenges the original idea behind PPP as mentioned earlier. These divergent views have been driven by the public sector and international development agencies as they seek for more efficient ways of facilitating infrastructure development and delivery. Hodge & Greve (2007) indicate that PPP is a language game where the public sector, in the bid to extend existing forms of public management, such as privatization, have created a buzz word designed to cloud existing strategies of assessing private investment in the development of public infrastructure. They go on to indicate that each national public sector have varied ways of describing what they mean by PPP. They cited the case of Britain and Australia, where PPP and privatization are seen to connect in the former and vice versa in the latter. Hence, they indicate that is difficult to judge what PPP is.

Today, as seen in the table 4.1 above, aside the divergent public sector views on PPPs, based on the synonymous words to partnership, the public sector has extended the concept of PPPs to include '*commercial transactions*' '*range of possible relationships*' and '*any arrangement'*. This is where there has been confusion on what people refer to as PPPs as well as the development of the new terminology PPIs. Under this new umbrella (PPI), concepts that were disputed as not being PPPs could now be seen as PPPs. Such concepts include subsidization, partial privatization, outsourcing, etc. (Poole, 2008) (McQuaid & Scherrer, 2008). There were initial objections to these concepts being identified by some in the academia (Khanom, 2012) (Weihu, 2006).

Although these rejections are valid in a way, they are only valid when one sees PPP as a means of injecting private funding into the development of Public infrastructure. Today, most utility infrastructure is privately owned and as seen earlier in the previous chapter, there is renewed interest in the public sector direct involvement in expanding telecoms infrastructure. Rather than re-nationalize, as in the case of Brazil, the public sector is now injecting funds to aid the expansion of private infrastructure. One would see this as a *'flip PPP'*. Hence part of government funding activities emanates from subsidies, grants etc.

However, although the variations in the outlook towards PPP exist from a national or the international development point of view, one cannot go back in time to rebrand privatization, management contracts and even outsourcing as PPP. This is because PPPs could be an institutional cooperation, long-term infrastructure contracts, public policy networks with loose stakeholder relations, civil society and community development in which the partnership symbolism is adopted and a tool for urban renewal (see (Hodge & Greve, 2007)). As an Institutional arrangement, PPPs are usually a complex set of arrangements that could encompass any set of forms. Therefore, one would say that PPP could be a form of any of these concepts and not vice versa. For example PPPs could be said to be a form of Privatization as it involves private participation in the public infrastructure delivery (See (Savas, 2000)). One would also say that PPP is a form of outsourcing as public activity is outsourced to the private sector. One could also say that PPP is a form of a joint venture partnership and not vice versa. For example, in a PFI, where the private and public sector concurrently jointly own and operate the infrastructure during the contract period, the public sector leases the infrastructure from the private sector during this period and operates it at the same time with the private sector. Here there will be a merger in public and private agency operations and percentages determined from the accrued revenue during the contract period. This does not affect the obligations of each party as stipulated by the contract. So in this case one would say that this is a joint venture within a PPP. Sill in the same project even though the infrastructure is jointly owned, one of the reasons the private sector was made a partner was because the public sector wanted to outsource the building of the infrastructure. In this complex example, one would not say that PPPs is the same thing as outsourcing or joint ventures, as PPPs arrangement could take varied complex forms. These forms are usually determined by financial consultants who are hired to iron out a way a complex or an expensive infrastructure project can be financed (Department of Economic Affairs, 2010).

What makes these new direct financing alternatives PPPs is the fact that the injection of public cash into the project is the '*new resource'* the public sector commits directly to aid a specific or set of sectoral projects. Hence, as the public sector no more owns most of the infrastructure, partnerships could therefore be defined in different ways as seen earlier, depending on the angle of existing national laws permitting the private sector to operate. As no country wants to drive off Foreign Direct Investments (FDIs), this path is being traded carefully to secure maximum benefit for both sectors. It is possible that as a new expensive infrastructure possibility emerges, so will new concepts of partnerships regarded as PPP.

The outlook of PPP today is accidental as a result of unforeseen events. As mentioned in the previous sub-section, the world financial crises of 2008 exposed the myth of 'private good and public bad,' being circumstantially true. This implies that under a favorable economic climate, the public sector would be the best supplier. In chapter 2, one would realize that once new innovations were birthed, the private sector was more efficient in the telecom infrastructure diffusion process. However, at the peak of the diffusion of the innovation S-curve, one would see the public sector intervene in various ways. So here it would be said that the world economy moves in a cycle. In one part of the cycle less public intervention is needed, in another phase some form of public intervention is needed.

Hence, based on this analogy, one would realize that now the concept of PPP has evolved to include the Public co-financing of private infrastructure (Private DBO), bottom-up, public DBO, and forms of outsourcing and joint ventures (Yardley, 2012). The rationale for choosing these forms of PPPs is because one could call them an extension of the previous traditional PPP models as will be seen in section 4.5. Secondly, they have been used in financing Broadband initiatives. Hence, although a case cannot be made for other form of infrastructure financing, one would realize that one of the ways the public sector disburses finance is via subsidies and grants among others. In the chapter 3, mention was made of some examples of public investment in the development of Broadband.

4.1.3 PPP IN THIS REPORT

Having established this point, one would say that the use of the word partnership for PPP in this thesis to denote a '*contractual arrangement..*'. This is supported by (CEPA, 2010) (Hart, 2003) (Gray, Hall, & Pollard, 2010) (Hearne, 2009) as mentioned earlier in this chapter. As PPPs cannot be said to exist without a direct legal document or contract spelling out specifically the roles and responsibilities of the public and private sector with respect to the PPP project at hand. However, this is not to discard other definitions that involve collaborations, cooperation and loose relationships. In this report, as long as there is a binding contract that establishes the role and responsibilities of both the public and private sector with regards to a joint project, be it collaborative or cooperative, it will be recognized as a PPP. Else it will be identified as a PPI.

The organization of PPPs varies with regards to their legal status, governance, management, operational roles, policy setting prerogatives and contributions (Jamali, 2004)

4.2 HISTORY OF PPPS

There is no consensus on the origin of PPPs. PPP has been viewed as either an age old phenomenon or a recent concept. In the case of the latter, it has been regarded as a governance tool '*that has been around, quite a while,*' hence not a new phenomenon (Borzel & Risse, 2005) (Ghobadian, O'Regan, Gallear, & Viney, 2004). This assertion has been backed by some examples as seen in the table below.

Table 4- 2 Ancient PPP Institutional Arrangements

	Time Period	**Region/countries**	**Project**	**PPP Arrangement**
1	Ancient times to	Europe eg Roman Empire,	Harbour, markets, Public baths	Concessions to private sector
2	Middle ages	Today's France	Construction of fortified towns	Concessions to private sector
3	16th and 17th Century	Today's France, UK and other European countries	Construction of riverbed, canals, road pavement, and waste collection, public lighting, mail distribution,	Concessions to financial investors
4	19th century	Europe	Infrastructure and service	Concessions

			delivery	
	Pause by the world war and communist ideologies			
5	After 2nd World war	Italy, US, Japan, France, Spain and few Western countries	Construction of toll Network motorways	Toll road Franchise and PFIs
	Between the 1960s and 1970s			

Source (Ghobadian, O'Regan, Gallear, & Viney, 2004)

To get a clearer picture, the table below outlines a few specific projects within this period.

Table 4- 3 PPPs in Ancient Times

	Period	**Country /Region**	**PPP Arrangement**	**Description**	**Source**
1	Ancient times	Roman Empire	Concession	The biblical Matthew, a biblical private tax collector, who operated a tax collection agency on behalf of the Roman Empire,	(Hodge & Greve, 2007)
2	15th Century	US (UK North American colonies)	PFI-DBFO but with public grant	21 year concession granted to Thomas Neale in 1691 by King William and Mary of England to erect, settle and establish post office in North America. The English crown financed the project.	(Huebner, 1906)

3	16th Century	France	Franchise/ concession	Concession granted to Perrier to distribute water	(Monod, 1982)
4	19th century	Denmark	Concession	Concession to Falck operate Municipality fire Brigades and ambulance services	(Hodge & Greve, 2007)
5	1950s	Hong Kong	BOT	The Harbour tunnel Project	(Grimsey & Lewis, Evaluating the risks of public private partnerships for infrastructure projects, 2002)

Williams (2015)

The history of PPP as a recent concept can be identified during the post world wars' period, also as a post-privatization concept and from a nationalistic point of view.

The Postwar Period: There is another school of thought that believes that PPPs could be traced back to the post world wars, where governments were eager to restore the city infrastructure with minimal resources (Grimsey & Lewis, 2002). city reconstructions were outsourced to the private sector.

Post-Privatization concept: Another school of thought PPP was born out of the need to bring in more private sector involvement to the development of public infrastructure based on the success of privatization (Jamali, 2004) (Savas, 2000). This implies that PPPs are an evolution of privatization. The rationale of this thought is expanded by Hearne (2009) who explains that PPP is by product of neolibralism as the public sector in the West, especially in the UK and US, shifted public policy from Keynesian policies (that encouraged state interventions) to neolibralism which promotes a market economy (where private sector participation in the delivery of public infrastructure provision was encouraged).

National origins: Hearne (2009) believes that PPP as a concept was introduced first in the UK by John Major's conservative government in 1992. Sadka (2006) concurs with this fact, but believes that the concept was initiated in the UK in the early 1980s as a broader part of the privatization program by Mrs.Thatcher's

Conservative Government. Grimsey & Lewis (2002) agree with the fact that PPP's via PFIs were introduced in the UK in 1992 and Australia had PFI projects as far back as 1988.

Looking at the various outlooks towards PPPs, one would say that PPP has been practiced unknowingly throughout the ages. However, one would also say that the institutionalization of PPPs occurred towards the last couple of decades in the last century (20^{th} century). This is when the concept was christened PPP and conscious steps were made to institutionalize it. The rationale for looking back at the history was to understand the concept of PPP and what it entails.

Another clear point here is that all concessions are not PPPs, the examples selected in this chapter are not all the examples cited by the authors. There were other examples that fitted more into service contracting. Examples include the private cleaning of street lamps in 18 century England and the use of private naval fleet alongside that of the royal navy in the 1588 war with Spain, where the British conquered the Spanish Armada (Hodge & Greve, 2007). The reason for choosing the examples above are based on the current outlook towards PPPs as either PFIs , BOT or any of the examples that will be mentioned in the next subsection.

4.3 SOME TYPES OF PPP ARRANGEMENTS

These arrangements can be viewed in two ways, namely: The initial PPP institutional arrangements and current PPP institutional arrangements. The reason for the split is because the initial agreement had emphasis on the infusion of private finance to develop public infrastructure and the latter is vice versa. In this section, the form of PPP arrangements will be discussed. In the section the discussion will be centered on the different forms of PPP arrangements. These arrangements range from overall institutional arrangements, financial and organizational relationships, the infrastructure sharing model and the new PF2 initiative.

4.3.1 SOME INITIAL PPP INSTITUTIONAL ARRANGEMENTS

These early modern PPP institutional agreements in Australia, UK and some part of Europe were either PFIs (Design, Build, Finance and Operate (DBFO)) or Build-Operate-Transfer (BOT) (Grimsey & Lewis, 2002). In the US, the popular forms of PPP aside the aforementioned ones were more of long term contracts than concessions (Hodge & Greve, 2007). Other forms of contracts and concessions were not limited to: Build-Operate-Own (BOO), Build-Own-Operate-Transfer (BOOT), Build-lease-transfer (BLT), Design-Construct-Manage Finance (DCMF) (Williams & Falch, 2014). In this section, the PFI and the BOT contract will be explained. The other models will be represented in the table below.

Some of these arrangements are still used today and new arrangements are coming up by the day. In this section, a few examples will be mentioned.These include DBFO and BOT and other PPP Models.

PFI-DBFO

Gray, Hall & Pollard (2010) explains the three step process in a PFI.

- A private firm or consortia is contracted to design, build, finance and operate the infrastructure under the specifications decided by the public sector. Here the upfront cost is borne by the private sector.

- The infrastructure is then leased to the public sector on a long term concession, where the public sector makes annual payments to the private sector. In this manner the private sector could recoup its investment.

- The private sector hands the infrastructure back to the public sector at the end of the contract, if the contract period is not extended.

Examples of PFIs constructions can be seen in the table below.

Table 4- 4 Examples of PFI Initiatives in the UK

Country	PFI project	City	Utility	Sector	Concession period
Canada	Canada line	Vancouver	Rail line	Transport	35
Sweden	The Karolinska Solna Hospital	Stockholm	Hospital	Health	25
USA	The Chicago Skyway	Chicago	Road	Transport	99
UK	M25	London	Road	Transport	30
Nigeria	Development of 4 districts	FCT		Urban Development	NA

Source: (Gray, Hall, & Pollard, 2010) (UK Highway Agency, 2009) (ICRC Nigeria, 2014)

There are lots of other DBFOs that have been adopted from the early 1980s to date in various sectors of the economy in various countries. In the UK, for example, in 1987 to the end of 2004, 677 PFIs (PPPs) worth £ 43 Billion has been completed (McQuaid & Scherrer, 2008). The private sector involvement in DBFOs could be as a single private sector entity, or as a consortium known as Special Purpose Vehicles (SPV) (Department of Economic Affairs, 2010). The examples listed in the table above mostly represent private sector stakeholders that were represented as SPVs. However, CEPA (2010) argues that all PFIs that involve no fixed payment stream from the public sector cannot be regarded as PPPs. That could be true in a sense, one should realize that the public sector contributes, in the planning and design of the project, it is also contributing its expertise (be it limited) to the project.

BUILD-OPERATE-TRANSFER (BOT)

BOT is a more popular form of the early PPPs as the public sector is granted the concession to Build, Operate the infrastructure for a period and Transfer it to the public sector. It is believed that the description of this form of contract as BOT was in early 1980s in Turkey (Grimsey & Lewis, 2002). Quite unlike the PFIs, in this case the financial obligation rested on the private sector and they bore all the risks as well. The private sector also owns the infrastructure during the duration of the contract.

In the telecommunications sector, Jamali 2004 identifies this form of PPP being used to kick start the cellular market in Lebanon. France Telecom Mobile Liban and Liban cell were granted a 10 year concession to Build-Operate and Transfer telecom infrastructure in Lebanon (Jamali, 2004). Other examples of BOT include The Cross Israel Highway project (Sadka, 2006). The concession period granted to the SPV was 30 years. The Hong Kong Harbor tunnels in the 1950's, the third Dartfords crossing (UK), The Sydney Habour Tunnel, Australia to mention a few (Grimsey & Lewis, 2002).

OTHER PPP MODELS

The other forms of PPP are the concession and contractual arrangement listed in the table below and the Municipality model.

Other Concession and Contractual Arrangements: These models represented in this table are used in North America (Canada & USA). The caveat here is that this report does not agree to the fact that the PPP institutional arrangements marked with * are PPPs, they are regarded in this report as PPI as they refer more to service contracting.

Table 4- 5 PPP Institutional Arrangements prevalent in North America

PPP arrangement	Description	Private sector responsibility	Public Sector Responsibility	Country
Operations & Management (O&M)	The private sector, under contract operates a publicly owned asset for a specific term	Project Operations and Maintenance	Project ownership and Management	USA, Canada
Operations, Maintenance and Management (OMM)	The private sector contracts the private partner to operate maintain and manage a facility for service provision.	Private capital investment	Project ownership	USA
Design Build* (DB)	Private sector designs and constructs a project for a public agency	Design and construction	Project owner	USA
Finance only	The funding of public infrastructure through long term lease or bond lease	Private finance and ownership during lease period	Public ownership	Canada
Build-finance (BF)	The private Sector constructs and finances the capital cost during the construction phase.	Private finance	Public sector ownership	Canada
Design-Build-Maintain(DBM)	The private sector, designs, construct and	Design, builds and maintains the	Owners and operators of the	USA

	maintains the facility for time period	asset	assets	
Design-Build-Finance-Maintain-(DBFM)	The private sector builds, designs , finances the project on a long term maintenance service	Designs, Builds, maintains and finances the project	Ownership and operators of the project	Canada
Design-Build-Finance-Maintain-Operate (DBFMO)	The private sector builds, designs , finances, maintenance and operates the project on a long term service	Private sector finance and operations	Owners of the project	Canada
Design Build Operate (DBO)	The private sector designs, construction and operation of a project	Implementers of the project	Owners of the project	USA
Design Build Operate Transfer (DBOT)	A DBO where the private sector jointly owns the project during the contract period. The infrastructure is transferred back to the public sector at the end of the contract	Builds, operates and owns the project during the contract period	Owners of the project	USA
Design-Build Own-Operate (DBOO)	A DBO, where the private sector involvement is infinite	Builds, operates and owns the project	Owners of the project	USA
Design- Build-Operate-Maintain	A project where the design & construction as	Designs, construct, operates and	Owns and finances the infrastructure	USA

(DBOM)	well as the operation& maintenance is handled by a single private entity	maintains the infrastructure	development	
Build-Operate-Own (BOO)	The private sector finances, builds and operates the facility in perpetuity	Facility development and ownership	Regulation and contract obligations (eg. market incentives)	USA, Canada

Source (NCPPP, 2012) (CCPPP, 2005)

In Canada and the USA, PFIs took a different approach. While the UK and British Common wealth nations adopted the Design-Build-Finance-Operate (DBFO), in the North America, there was the maintenance component to the private sector responsibility (NCPPP, 2012) (CCPPP, 2005). Hence Design-Build-finance-Operate-Maintain (DBFOM) (US) and Design-Build-Finance-Maintain-Operate (DBFMO) (Canada). In the US, there was another form of contract that entailed the transfer of the infrastructure at the end of the contract, hence Design-Build-finance-Operate-Maintain-Transfer (DBFOMT). Another difference between PFI in North America and the UK was the fact that, the public sector did not contribute financially to these forms of PPPs. Both countries have not limited their outlook to public private partnership to just those mentioned above. The rationale for mentioning these forms of contractual arrangements was to explain other various forms of PPPs.

Municipality Model: In Austria and Germany, PFIs were not popular as they were seen as expensive (McQuaid & Scherrer, 2008). Hence, in Germany and Austria small scale PPPs were mostly projects between the municipalities and the private sector and the institutional model were contracting models aimed at energy projects, educational and sports infrastructures among others (McQuaid & Scherrer, 2008). In these countries there were PPPs between the central governments and the private sector, but were of smaller volumes than PPPs at the municipality level. The reason for adopting PPP in these countries was to bridge the infrastructure gap rather than accept PPP as a greater Innovation and efficient management of public infrastructure delivery as viewed in the UK (McQuaid & Scherrer, 2008)

4.3.2 FINANCIAL AND ORGANIZATIONAL RELATIONSHIPS WITH PPPS

As mentioned earlier in this report, PPPs could assume any form and as seen in the institutional arrangements listed above among many others. It is important to note that there are no standard PPP arrangements for all PPP projects. These arrangements are often made with the aid of financial institutions (Department of Economic Affairs, 2010).

Table 4- 6 Financial and Organizational Relationships of the Types of PPP

Finance/Organization	**Tight Organizational Relationship**	**Loose Organizational**
Tight Financial relationship (infrastructure development)	Joint Venture companies Joint stock companies Joint Development projects	BOOT, BOT, Sale-and-Lease-back and other forms of concessions and long term contracts
Loose Financial relationship (Policy development)	Policy communities	Issue networks

Source (Hodge & Greve, 2007)

However, as seen in the table above, most PPP arrangements meant for Infrastructure/ service delivery are made up of temporal entities (both public and private) that are disbanded at the end of the project. These entities from the private sectors are consortiums or consortia called Special Purpose Vehicles (SPVs) in most jurisdictions. The SPV could be made up partners from the different private enterprise of interests, financial institutions, donor agencies and any other entity, including the public sector. The SPVs could be one or two or more, depending on their competencies, interests and the amount of money needed to finance the heavy project. Based on these arrangements, relationship between the SPV and the public sector could be in the form of a temporal joint-venture, temporal joint stock company or synergy in the development of public infrastructure. These are tight organizational relationships that are formed based on the risk, especially the financial risk involved (Hodge & Greve, 2007). Hence they will have a tight financial relationship. The contracts could take any of the aforementioned formats or other PPP arrangements.

On the other hand, still on infrastructure delivery, the public sector may not want to contribute organizational resources to the private sector. Hence, although they are partners, the private sector bears most of the risk. Although there is contract and some form of cooperation between the SPV/ single private entity with the Public sector, much of the implementation and operation of the project comes from the private sector, an example could be in the case of Build-Own-Operate-Transfer (BOOT) or Build-Operate-Transfer. In this case the financial relationship will be tight as the public sector has to provide, for example loan guarantees for the private sector; however, the organizational relationship will be loose as the private sector carries out most of the work for the public sector.

In the second form of PPP represented in the table above, PPPs aimed at policy development do not require enormous financial resources, hence there will be a loose financial relationship (Hodge & Greve, 2007). However, in policy communities such as the UK Broadband group mentioned earlier, the members of the policy group share the same interest and the same goals. They have beneficial benefits in whatever policy would emerge. Hence to ensure that their interests are protected, they are forced to form a tight organizational relationship and even co-opt more members that can further their cause. Issue networks (alliances of various interest groups) are a form of policy network or, however, issue networks unlike policy networks are not tightly organized. Although they galvanize around a single issue, their interest level is not as high as that of policy network members.

4.3.3 SOME PPP INSTITUTIONAL ARRANGEMENT TODAY

The institutional arrangements mentioned here will be related to Broadband development. In this section of this report, the PPI initiatives discussed includes Public-Private Partnerships with regard to Broadband infrastructure development. Identified PPPs include public management concepts such as PFI-DBFO, Private–DBO, Public DBO, Joint Ventures and public outsourcing.

In this section, examples of these PPPs in the development of Broadband are discussed. Such examples include Joint ventures, PFI-DBFO and DBO. As mentioned earlier, Outsourcing and joint ventures are not PPPs in themselves, but possible arrangement in which a PPP could be organized. However, outsourcing could take any of the following contract or concessional arrangements mentioned in section 4.3.1 and joint ventures could also be arranged in the same manner. It is all about how the public and private sectors decide to share resources and organize themselves to achieve the common or shared goal. What is new today from the examples cited are the new form of DBOs, bottom-up model and the transformation of PFIs.

PRIVATE DBO

DBO is an acronym for Design-Build-Operate. The public sector owned the network. However, in the case of a private DBO, the public sector provides commensurate financing towards the development or often in the expansion of the Broadband network (Yardley, 2012). The difference between a private DBO and traditional service contracts is that these private DBO contracts are long term and the project life cycle is not segmented as the public sector deals with one entity, mostly a consortium which will be in charge of the design & construction as well as Operation and maintenance of the infrastructure. Secondly, the private sector does not own the infrastructure developed through traditional service contracts.

One would say that private DBOs are an extension of the old form of contracting the Design-Build-Own-Operate (DBOO). But the difference here is that the involvement and infrastructure ownership by the private sector is perpetual. The public sector does not own the infrastructure, however the injection of public capital is based on the fact that telecom services are essential and they are public goods. In section 3.4.4, the table 3.4 here has examples of Private DBOs. The table presented an overview of private DBOs in regions across the world. Most investments in the development of Broadband and NGNs in the west today are Private DBOs. However, in developing countries such as Saudi Arabia and Pakistan, and the Dominican Republic, Universality funds is used to fund rural Broadband connectivity, fiber networks and rural wireless Broadband connectivity respectively (Yardley, 2012). In Sub-Saharan Africa, there are lots of cases where the private sector fund infrastructure development using universality funding. These are not Private DBOs as in most cases, these are traditional service contracts employing the private sector to design, construct, operate or maintain public infrastructure.

PUBLIC DBO

Public DBO is a switch from the original DBO, where the private sector bears most of the risk in developing the infrastructure. This is another form of public investment in the development of network infrastructure. However, in this case the infrastructure is designed, constructed and operated by the public sector, who then offers the network service on either retail or wholesale to the private sector to resale (Broadband Europe, 2011). The Almhut Swedish case mentioned in this report is an example of this form of PPP.

In Chapter 3 mention was made in the case of municipality involvement in the development of Broadband in the United States of America and Canada. Some of the possible arrangements between the municipality and the coop could be public DBOs. These are examples of Public DBOs. Other examples include the Västerås (Sweden), North Karelia (Finland), Bizznet (Austria), RAIN

(Lithuania),CityNetCologne (Germany) to mention a few (Broadband Europe, 2011). Let us have a look at one of the cases - The case of the Rural Area IT Internet (RAIN) Lithuania.

In the case of RAIN project, the managing authority is the Lithuanian Ministry of transport and communication and Public enterprise Placiajuostis Internetas. This public management consortium is registered as a Non-Profit Public enterprise. Funding is from Government grant and external donors with the total funding of $63.1 Million USD. The infrastructure is a national Backhaul. Source: (Yardley, 2012).

In sub-Saharan Africa, an example of a Public-DBO is the Voltacom fiber optic backbone, which is now owned by Vodafone Ghana. The idea behind the upgrade and expansion of the network by the public sector was to lease capacity to the private sector. However the relationship between the Government of Ghana and the private sector did not last long, as the network operators have so far developed their private backhauls competing with the existing former Government infrastructure.

In the west, one would see Private DBOs as an extension of the municipality model which has existed for many years as mentioned in chapter 2. However, municipality Public-DBOs is very rare in sub-Saharan Africa.

BOTTOM-UP MODEL OR LOCAL COMMUNITY MODEL

This model is same as community based networks. Here a community of group of people with common interests come together to develop a network that will enhance their socioeconomic environment. This is one of the central tenets of this report. However, this bottom-up approach cannot be said to be a PPP if the public sector is not actively involved in the project by financing the project or providing legislative guidelines as seen in the Telpin case, earlier in this report. Although the bottom-up approach to telecom infrastructure development is not new, the PPP where the public sector is actually involved in such an endeavor is rare in terms of national adoption. Up till now the public sector has been in favor of the top-down approaches. However the bottom-up initiatives that exist in the EU have been adopted for the development of both wireless and fixed Broadband infrastructure. In the US, and elsewhere most community based networks are pure private initiatives with no government assistance. In sub-Saharan Africa, aside the Republic of South Africa, where there are some wireless groups, a test was carried out in Tanzania called the Serengeti Pilot (Nungu & Pehrson, 2011). This was a test project by the ICT for Rural Development (ICT4RD) in Tanzania. But it has not been implemented since then.

Box 4- 1 Examples of Bottom-up Model Facilitating Wireless Broadband Infrastructure

However, in the UK, there are government initiatives aimed at facilitating the bottom-up approach. In the UK, the rural community Broadband fund in February 2014 was established help fund rural Broadband bottom up approaches (The Telegraph, 2014). Between 2013 and July 2014, 3 communities got funding and 2118 domestic, business and other premises in hard to reach rural areas were believed to be connected (Department for Environment Food & Rural Affairs, 2014). The minimum targeted data rates for these areas are 2Mbps for the first phase and 24 Mbps in the next phase.

In Scotland, Community Broadband Scotland, a Scottish Government project led by Highlands and Islands enterprise fund community based networks (Community Broadband Scotland, 2014). Community Broadband Network is another UK Governmental initiative launched in 2004 to help fund community broadband initiatives in rural UK (CBN, 2014). In these approaches, the communities apply for funding to these public organizations for wireless broadband projects, mostly Wi-Fi.

Box 4- 2 Examples of Bottom-up Model Facilitating Fixed Broadband Infrastructure

In the Netherlands, the PPP arrangement was different as the bottom up approach was more of a demand pull than a supply push as in the case of the UK. The cooperative, OnsNet Nuenen, which has metamorphosed into a commercial entity (OnsBrabantnet) was formed in 2004. The purpose of this democratic association was to acquire regional subsidy from the Eindhoven Regional Government to develop Fibre-to-the-Home (FTTH) for their community. The coop was made up of 7500 households as people from neighbouring vicinities signed up. The subsidy of 800 Euro per capita (per person/household) was received, where 500 euros was for construction and 300 Euros for operations. There was also access to National subsidies (35000 Euros for small services, 4000 Euros for large services) and regional subsidy (maximum 40000 Euros). The first year of subscription was free. The grant was not sufficient, hence a deal was made with a network Operator in Nuenen called NEM Nuenem BV who became the owner and operator of the network and could recover the additional cost to the subsidy provided supplying Broadband services via the network. This NEM did this by negotiating contracts with Broadband service providers. By mid 2005, 80% of the households had fibre optics connectivity. Source (Cooperatie OnsNet Nuenen UA, 2014)

THE DIFFERENCE BETWEEN THE BOTTOM-UP MODEL AND PUBLIC DBO

The difference between public-DBOs and the bottom-up model depends largely on who takes the initiative. In the case of the public-DBO, the public sector takes the initiative and invites the communities or local groups or NGOs. In this case, the public sector has a design and a vision on how to go about the project. They sensitize the private sector (including non-profit, non-commercial and profit-oriented) on their plans as a way of stimulating demand for the infrastructure that the public sector will develop. The public sector, then goes ahead to develop the infrastructure. Here the public sector owns the assets.

However, in the case of the bottom- up approach, the vision, the design (choice of technology, etc.), construction, operation and maintenance of the infrastructure is decided by the cooperative. The only direct role the public sector plays it to fund the project. Here the non-profit private sector (coop) owns the infrastructure and the assets.

4.3.4 INFRASTRUCTURE SHARING MODEL

This a model proposed for the development of 4G infrastructure in Kenya. It is yet to be implemented. In this case, the Public sector would grant the network operators one 4G license to develop a single infrastructure and provide open access to each other as well as new entrants to the joint license (Williams, Adjin, & Tsivor, 2014). The advantage of this model is the reduction in cost in the development of 4G LTE, the eradication of infrastructure duplication in areas that are commercially viable, as well as the expansion of network infrastructure into areas that are rural and commercially unviable. This model was inspired by the success of the country's TEAMS international fiber optic deployment success using the PPP model. The infrastructure was meant to be owned by the consortium of Network operators while the public sector provided regulatory and legislative backing.

Another example of an infrastructure sharing model, which also doubles as a multinational Private Build, Operate, Own, form of PPP. In this case Governments of Eastern and Southern African countries represented by NEPAD, 2 consortia of private network operators, international development partners and financial partners signed an agreement to facilitate International Backhaul connectivity to serve Southern and Eastern African countries. Initially, most of the private network operators were national monopolies when the contract was signed, as they represented their government. The arrangement, then was a multi-national joint venture. However, as these countries privatized their telecom monopolies, the EASSy consortia became more private. The role of the multi-national public sector represented by NEPAD became more of regulatory and in some cases conflict resolution czar. In the design of the network, the basic idea was infrastructure sharing and open access to new entrants to interconnect (NEPAD e-Africa Commission, 2012).

This is a model of PPP that may be used more in the future if it actually leads to the reduction of cost in the development of Broadband Infrastructure, leads to quality infrastructure delivery and is not anti-supply (becoming expensive for the end user). However, in the case of EASSy, Kenya's decision to develop its own international bandwidth, even though it was part of the EASSy project was based on the fact, that the use of the infrastructure favored South Africa more than Kenya (Williams & Kwofie, 2014). Hence, there was the need to create competition. Another case was the delay in the members of the consortia coming into favorable agreement in the sharing of resources that would enable them to work together. These are possible challenges to the infrastructure sharing model.

4.3.5 PF2

This is an evolution of the PFI model. It was launched in late 2012 as PFIs were seen not to have lived up to its 'Value for money' expectations. This was because huge financial expenditure for delivering the infrastructure did not meet the design criteria – leading to the delivery of sub-standard infrastructure (Quiggin, 2004). In a report published by the UK treasury, their reasons for adopting the PF2 were as follows:

- Not getting value for money from most projects. Aside the aforementioned reason, the PFI procurement processes were often expensive and slow for both sectors, thereby reducing the value for money. Hence the taxpayers were not getting a fair deal on the short and long run of the projects.

- PFI arrangements were not always flexible, hence alteration during the operational period became difficult.

- There was a lack of transparency on the financial performance of the projects and returns made by the investors. Hence the future liabilities for the taxpayers created by PFIs, and the returns made by investors were not clear.

- Inappropriate risks were transferred to the private - sector making the risk premium charged to the public sector higher.

- There was also a conception that equity investors in PFI projects made huge gains which led to the public reassessing the projects to determine value for money.

- The changes in the global financial market affected the PFIs.

- PFIs were adopted in projects where its applications were unsuitable

Source (HM Treasury, 2012)

As a result of these factors, among others a tension was created between PFI providers, the public sector and the wider public.

However the changes between PFI and PF2 centers on:

- The time limit for negotiating projects (18 month)
- Transparency in profit operator revenues
- Greater flexibility to change service contracts
- The state would be able to stake up to 49% in each project (This implies the direct introduction of state financing).
- The private sector would be able to access the capital market and other sources for debt-financing for the project.
- The private sector would be required to only bid for projects as long as bank debt does not provide the majority of their financial requirement.
- The public sector would explore more efficient debt financing solutions to attain value for money.

Source (HM Treasury, 2012)

Aside these new amendments, nothing has changed structurally for PFIs as it is still relying on private financing and expertise. The financing structure has not changed but only modified. Hence, in order to achieve value for money and transparency, PF2 has been redesigned to cushion the effect of debt financing of infrastructure as well as provide new initiatives towards transparency to build public trust.

4.4 CLASSIFICATIONS OF PPPS

The classification of PPP in literature generally denotes the area which is considered PPP in the literature. However, since international donor agencies and the public sector drive the PPP discussion, it is important to understand how they classify the various arrangements. However, individual nations do not necessarily classify PPPs but list the various arrangements. In this section the classification of PPP by The United Nations Economic and Social Commission for Asia and the Pacific UNESCAP, The World Bank, Asian-Pacific Economic Cooperation (APEC)

Table 4- 7 Classification of PPP by UNESCAP

Broad category	**Main variants**	**Ownership of Capital Assets**	**Responsibility of Investment**	**Assumption of risk**	**Duration of contract**
Supply and Management contract	Outsourcing	Public	Public	Public	1-3
	Maintenance Contract	Public	Private/Public	Private/ Public	3-5
	Operational Contract	Public	Public	Public	3-5
Turnkey		Public	Public	Private/ Public	1-3
Affermage/ Lease	Affermage	Public	Public	Private/ Public	5-20
	Lease	Public	Public	Private/Public	5-20
Concessions	Franchise	Public/ Private	Private /Public	Private/Public	3-10
	BOT	Public/ Private	Private/Public	Private/Public	15-30
Private Ownership	BOO/DBFO	private	Private	Private	Indefinite
	PFI	Private/ Public	Private	Private/Public	10-20

	Divestiture	Private	Private	Private	Indefinite

Source (United Nations, 2011)

The World Bank classifies PPP as follows:

- Utility Restructuring, Corporation and decentralization (Corporatization and Municipality aggregation)
- Civil Works and Service Contracts
- Management and operating contracts (BOT/concession agreements) (2-5 years)
- Lease/Affermage (8- 15 years)
- Concessions, Build-Operate-Transfer (BOT) and Design-Build-Operate (DBO) Projects (25-30 years)
- Joint Ventures and Partial Divestiture of Public Assets Full Divestiture
- Full Divestiture/ Privatization
- Contract Plans and Performance Contracts

Source (Worldbank, 2014)

The Asian-Pacific Economic Cooperation classifies PPPs as follows:

Service contracts, BOT, Concession, Management Contract, Partial divestiture, Rehabilitate-Operate-Transfer (ROT), DBO (Asian Development Bank, 2008).

Based on the examples seen above, one would say that the inability to classify PPP arrangements in a standardized way is based on how the public sector and development agencies view PPP. However, so far in this report, the safe approach has been adopted to use the term PPI in looking at various forms of Public-Private relationships and PPP for contractual agreements where the public and private sectors share responsibility and risks.

Classifying PPPs in this report will contribute to the confusion as PPP arrangements continue to grow. However, one would say that unless PPP is redefined in a standardized way, it will be difficult to classify it. One should not lose sight of the impact of the global economy on how the public sector views new forms of PPP.

4.5 RATIONALE FOR PPPS

The rationale for PPPs can be viewed in two ways. The first being the initial practice of sourcing for private capital to develop public infrastructure and the second being the practice of Public capital being injected to expand private networks. The public sector in the UK for example, was interested in the efficient provision of public services and infrastructure (rationale for PFI); the selling of Public sector services to other; the incorporation of private ownership of public infrastructure and service as well as creating a synergy where the public and private sector and any other sector could work together to promote economic and social development policies (e.g. The Broadband Stakeholder group) (McQuaid & Scherrer, 2008).

4.5.1 RATIONALE FOR SOURCING FOR PRIVATE CAPITAL TO FUND PUBLIC INFRASTRUCTURE

In this section, the rationale for the public and private sector is explained.

Rationale for the Public Sector:

- Efficient service delivery at affordable cost to the public sector (CEPA, 2010) (Hodge & Greve, 2007).

- To achieve quality infrastructure delivery with Value for Money (CEPA, 2010) (Grimsey & Lewis, Evaluating the risks of public private partnerships for infrastructure projects, 2002).

- Risk and responsibility transfer to the private sector or allocation of risks and responsibilities by both parties (CEPA, 2010) (Jamali, 2004) (Department of Economic Affairs, 2010) (Grimsey & Lewis, Evaluating the risks of public private partnerships for infrastructure projects, 2002).

- Source private funding for public infrastructure development (Jamali, 2004).

- Alternative infrastructure investment mechanism in the face of scares and limited budgetary resources, aimed at cost efficiencies as mentioned in the first point (Sadka, 2006) (Jamali, 2004)

- To ensure public accountability in the delivery of infrastructure or service, (Hodge & Greve, 2007)

Rationale for Private Sector: For the private sector, the rationale was to ensure their Return on Investment (ROI) (See (Jamali, 2004) (CEPA, 2010). Based on this rationale, the private sector could invest in the infrastructure project, design the project, construct the project and even maintain the project for a period of time to recoup its investment as well as make profit (CEPA, 2010). One would say that this gave the private sector an incentive to bid for such projects.

4.5.2 RATIONALE FOR PUBLIC SECTOR FUNDING OF PRIVATE INFRASTRUCTURE DEVELOPMENT

Public Sector rationale:

- A utility such as Broadband are seen as essential good as well as public goods (Strover & Mun, 2006).

- The willingness of the private sector to expand its reach to underserved areas is not there.

- The reasons mentioned in section 3.3.4. are also valid here. It is better to cite it than repeat it.

Private Sector rationale:

- Infrastructure expansion will broaden the reach of the private network at a cheaper cost.

- They no more bear all the risk associated with supply such as interest rates on borrowing etc. the risks are now shared.

In the case where there is equity investment involved, the private sector could benefit from infrastructure sharing (in the case of Broadband).

4.6 VOLUMES OF PPP TRANSACTIONS IN TELECOM INFRASTRUCTURE DEVELOPMENT

PPPs has been widely accepted in different sectors of the economy and seen as a win-win situation as the interests of the public and private sectors can be furthered (Jonsson, 2014). However, investment in telecom infrastructure with respect to volumes is low. In the EU, for example, 11.7 Billion Euros were spent on 66 PPP projects in 2012 led by the UK, France, the Netherlands, Spain, Belgium, Italy, Germany, Ireland and Portugal (EPEC, 2013). In 2013, EUR 16.3 Billion was spent on 80 PPP projects (EPEC, 2014). In 2007, this region accounted for about 140 PPP projects valued at approximately 30 billion Euros (EPEC, 2013). In 2012 and 2013, PPP projects were channeled towards transportation, environment, health care and education primarily. However, in 2013 since 2010 the Ultra-High-Speed-Internet PPP in Auvergne in France was completed (EPEC, 2014). PPP in telecommunications in the EU has been very few.

Globally, Canada in 2012 was believed to be the leader of the pack when it comes to developing infrastructure with PPPs and the US is seen to less likely adopt the model full-scale (Deloitte, 2012). However, as seen earlier in this chapter, these countries are investing massively along with European nations and the Asians in the development of Broadband Infrastructure. In Africa, which is a case for this report there are also PPPs that exist in this region, but very rare PPP's aimed at telecom infrastructure development as mentioned earlier in chapter 3.

The reason for the low volume in the number of PPP transactions can be tied to the fact that Broadband infrastructure is highly expensive and secondly, the externality provided by a universal Broadband infrastructure does not call for volume of deals. Thirdly, one would say that there are other PPIs that would facilitate Broadband infrastructure development without having to adopt PPP, if feasible. Hence PPP as seen so far has been seen as a mechanism for developing highly expensive public infrastructure (Williams & Falch, 2014) (Savas, 2000).

4.7. CONCLUSIONS

In this chapter an effort has been made to shed light on the concept of PPP and to put it in perspective in comparison to PPIs. It will be difficult to say that PPPs is the "eureka" for Broadband infrastructure development. However, the high cost of Broadband infrastructure and NGNs may not be conquered with thought some complex arrangements such as PPP and probably supplemented with other forms of PPIs. The reason for the skepticism is based on the disadvantages of PPPs. This is why in this report, an attempt has been made to think outside the box by discussing PPI rather just PPP. As seen in the discussion so far, in the rationale for PPPs host the advantages of PPPs for both the public and the private sector. However, there are always unforeseen, which is termed disadvantages in this sense, such as: Market risks (insufficient demand), development and planning risks (feasibility of the project), project risk (timely infrastructure delivery and the quality of the delivered infrastructure), financial risk (exchange rate fluctuations and availability of credit), regulatory risk (is there an independent and solid regulatory framework in place) and political risk (will the political environment be stable throughout the project) (Newman, 2014). A force majeure is a possible risk as well. Other forms of risks exists in the complexity of the arrangement with regards, documentation, financing (mentioned earlier), taxation, technical details and sub-agreements (Grimsey &

Lewis, 2002). In an instance where the private sector is made up of consortia, then the risk expands as the members of the consortia do have an operating agreement among themselves. What happens if one of the partners defaults? These risks are mentioned to create a balance between the advantages and the disadvantages of PPPs. However, as seen in chapter 2 and in chapter 3 PPPs are here to stay and evolve as time goes on.

CHAPTER 5. THEORETICAL APPROACH

5.0 DEFINITION OF THEORY FOR THIS REPORT

This chapter begins with an attempt to define what is understood as a theory in this report. This attempt is made because the conceptual understanding of the word 'theory' varies depending on the context, discipline, field and philosophical outlook (Pettigrew & Mckechnie, 2001). As a result of the diversity in the understanding of the concept, Gary Thomas in his discussion about the relationship between theories and scientific inquiry queried the use of word "theory" (Thomas, 1997). His position was that the divergent view of the word robs the concept of a universal definition and that the insistence of the use of theories as road maps for scientific inquiries stifles creativity among researchers. Hence he questions why theories are relevant. However, despite the diversity in thought as to what a theory is, Key (1999) provides a generally accepted view of what a theory is. She explained that theories are generally believed to provide the roadmap on how to shape and order reality (Key, 1999). Key (1999) is also quick to add that "complexities of reality may be lost in the tradeoff of oversimplifying reality in order to achieve clarity and understanding'.

If one were to apply the philosophy of truth to both schools of thought, it is clear that there is no consensus truth of what a theory is. There is also no consensus truth on whether a theory is necessary as a tool for scientific inquiry. Both sides of the divide, from the private truth point of view and coherent truth point of views, are correct. However, this report does agree with Thomas (1997) that there is no consensus conceptual identification of what a theory is and disagrees with Key (1999) that the only function of a theory is to shape and order our understanding of reality. On the flip side of the coin, this report does agree with the need for a theoretical roadmap to understand reality as explained by Key (1999) and disagrees with Thomas (1997) that the theories necessarily stifle creativity among researchers.

One of the biggest problems, researchers face is how to explain a chunk of data in a coherent, rational and objective manner. Theories aid in creating a pathway for understanding the data and to describe or analyze the data. In such a manner, one would carve out some form of understanding of the phenomenon.

New theories can always be created by deductive logical reasoning, hence the argument of creative inhibition does not hold. However, one would say that the attempt for researchers to enhance creativity has led to the varied understanding and utilization of the concept called theory. It is also important to note that the conclusions arrived from theoretical induction or deductions may not necessarily be universal as the context of research, the scope of research and the audience of the research comes into play.

Hence from this point of view, this research adopts the use of theories for the description of the cases based on the data gathered. Thomas (1997) classifies theories into four categories, namely: scientific theory, theory as a developing explanation, theory as a hypothesis and theory as opposed to practice. He explains the scientific theory as the formal expression of ideas via a series of statements. He explained the hypothetical theories as ideas encompassed with modeling, heuristics, thought experiments and hypothesizing. He explained theories as developing explanation as the expansion of knowledge in particular fields and theory as opposed to practice as a form of reflection as opposed to doing.

This research utilized no clear set of features that one would say fits into one particular class created by Thomas (1997), rather its features cuts across theory as a hypothesis, theory as developing explanation and scientific theory. To understand the role of PPI in facilitating Universal Access via the vehicle of community Broadband initiatives, the research is centered around the theory as a developing explanation. This is because the sub-research questions demand explanatory answers. These explanatory answers can be deduced from descriptive theories. In this research the Actor Network Theory and the Stakeholder Theory serve as the analytical, descriptive tools aimed at identifying PPIs in both the primary and secondary case studies respectively. The result of the cumulative relationship between the descriptive theory and the explanatory answers will either broaden the knowledge produced in his research, accept the status quo or probably reject the theory.

This research studies society and how individuals relate to the society with regards to technology adoption. This classification situates the research in the social science domain. However, one of the theories, the Actor Network Theory has a non-universal rational epistemology in Callon’s Sociology of Translation (Callon, 1986). This rational epistemology has been adopted in the description of technological, social and natural networks (Ballantyne, 2015). Hence, one would say that, although it is not a universal ANT conceptual framework, it does consist of a systematic interlinking string of descriptive ideas that provides a logical conclusion. Hence from this point of view, one might say that, the research contains some element of a social scientific theory.

The research also has some elements of theory as a hypothesis. Hypothetical theory or most appropriately “*concepts*” are identified using the Grounded Theory. Data gathered from the field study as well as information distilled from the Stakeholder theory and the Actor Network Theory and further distilled using the Grounded theory. Grounded Theory is adopted to identify patterns as well as understand the factors that inhibited the growth of community Broadband Networks in sub-Saharan Africa. Grounded Theory was also adopted to understand the factors that did aid in the development of Community Broadband Networks. These factors did aid in the discussion of successful PPIs in the secondary cases and plausible actions that may be needed to facilitate more PPIs in sub-Saharan Africa for the purpose of attaining Universal Access and Service of Broadband.

Hence, for this research the theoretical considerations that will aid in responding to the research questions had to aid in providing explanations as well as explain relationships in the cases. Pettigrew & McKechnie (2001) did attempt to synthesize some definition of what could be considered a theory as seen in the table below. These definitions served as an inspiration on adopting a definition of a theory for this report.

Table 5- 1 Some Definitions of the term Theory

	Outlook to Theories	**Original source**
1.	A set of explanatory concepts	(Silverman, 1993)
2.	A statement or group of statements about how some part of the world works frequently explaining relationships among phenomena	(Vogt, 1993)
3.	An internally logical consistent proposition about relationships among phenomena	(Odi, 1982)
4.	A systematic explanation for the observed facts and laws related to a particular aspect of life	(Babbie, 1992)
6.	Generalizations which seek to explain relationships among phenomena	(Grover & Glazier, 1986)

Source (Pettigrew & Mckechnie, 2001)

The definition adopted in this report from the table above is that of Silverman (1993) and that of Grover &Glazier (1986). The adoption of these definitions was based on the criterion that this report provides explanations as well as explains the relationships in the selected cases for the purpose of identifying PPIs. As mentioned earlier, these adopted definitions do not invalidate the other myriads of definition out there. If one were to look at these definitions from the perspective of the concept of truth, one would say that these definitions have been adopted as the private truth on theories in this research.

5.1 SITUATION OF RESEARCH FIELD

However the core discipline of the report is Information and Communications Technologies (ICT). ICT is the study of how information is handled and communication facilitated with the help of technology (Moursund, 2005). Moursund (2005) explains that ICT was previously known as computer and Information Science. Based on this explanation two fields of study can be identified. That is Computer Science and Information Science.

However, this research is not a computer science research, but an information science research. McGonigle & Mastrain (2011) defined information science "as the science of information, studying, the application and usage of information and knowledge in organizations and the interface or interaction between people, organization and information systems". Information science has also been identified as a practical activity that extends information systems with the aid of the computer (computer science) and telecom technology (Brookes, 1980). Here the key words are "telecommunications", "information system" and "computer science". Some other fields that make up information science include cognitive science, communication science, computer science, library science and social science (McGonigle & Mastrain, 2011). This implies that Information Science is an interdisciplinary field.

However, with information science, the perspective of the stakeholders is taken into consideration when an Information Technology (IT) system or an Information System (IS) is being deployed in an organization or in the case of this report in a country (Stock & Sock, 2013). This description exposes the existence of another field IT. Hence, in situating this research, this research, information science was because of the social science, minor Information Technology (IT), rare computer science and rare Information Systems perspective of the report.

The implication of these three fields of studies rests in the fact that the supply and demand of Broadband Internet technology require the application of these three fields. However, in this research the emphasis was to distill the facets of the various fields with respect to the research rather than understand how the representative technology and service (Broadband Internet) can be facilitated.

The strongest facet of information science, where this research is inclined towards, is the social science. Cognitive science, communication science and library sciences are not needed in this research as they are not relevant towards responding to the research question. However, social science is a broad field, hence it was important to situate the social science aspect of the research under a smaller sub-field. The social science, adopted as a major part of this research, centers on human social interactions within a society (Harrison & Dye, 2008). Social interactions unfortunately do not exist in an atmosphere of individual equality because some individuals would tend to be more dominant than the others.

Harrison & Dye (2008) state that the theme that cuts across the social sciences is power relations in the society (Harrison & Dye, 2008). They define power as “the ability to affect the behavior of individuals via a real or threatened use of incentives and punishment.” This leads to power relations between the dominant individuals/organizations and the less dominant individuals/organizations. Dominance is derived from election, wealth, knowledge, service provision or the possession of any valuable resources that the dominated is in need of. Michel Foucault mentions an example of medical professionals having power over people’s existence (life and death) as well as their bodies and health (Foucault, 1982). Hence, to maintain dominance and not facilitate a shift in power relations, the dominating individual or organization has to bring together people to achieve their goals.

This act implies management. Management has been defined as the process of making sure that an organization will be able to sustain its operations both in the current times and in the future (Saunders College of Business, 2014). However, management cuts across different academic fields, including social science. This makes management an interdisciplinary field. From the social science point of view, and in understanding how the dominant power manages individuals/organizations it is important to identify a sub-field of social science that deals with social behavior. This will aid in studying how the social interactions in the organization between the dominant entity and the less dominant entity. At this juncture, the concept dominant entity will be replaced with a synonym “governing” or “managing entity”.

Hence, the social science field that aids in this understanding social behavior within groups and societies is sociology (see (Giddens, 1989)). Organizations are groups within a society and they are constructed by individuals within a society to serve a common purpose. The combined action of these individuals becomes the action of the group leading to some form of organizational behavior. The process of studying the metamorphosis of an organization is referred to as Organizational studies (Adler, 2009). Organizational studies are the sociological field that represents the social science aspect of this research.

Based on this analogy, one can say that this research would fit into a research tradition that portrays the interaction between then black box (technology) and society. In a nutshell from the point of view of this report, one would ask how the potential of a technology to societal interactions influence the efforts of the society to adopt the technology. However, on the flip side of the coin (which is not related to this research), one would say that the development of the useful technology, which the society is willing to adopt was not created via technical know-how alone.

One would say that the present need of the society as well as the existing knowledge of the scientist in the scientific (social) community played a role in the development of the technology. These arguments lead the situation of this research in the domain of the Science and Technology Studies (STS).

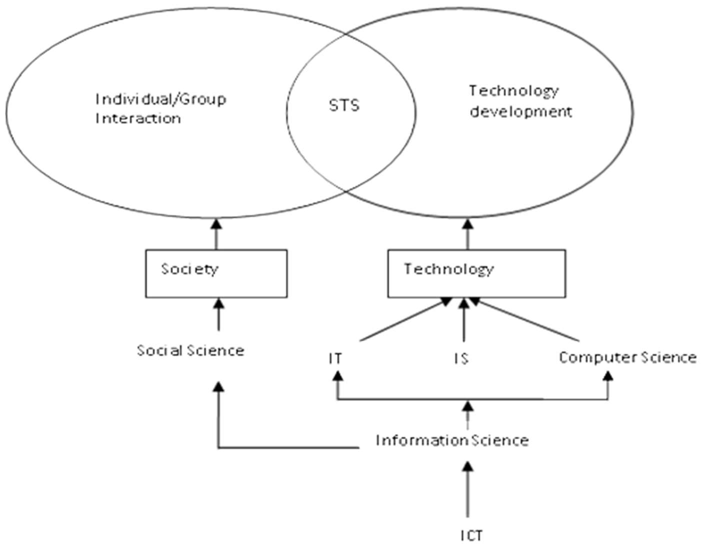

Figure 5- 1 Line of thought linking Information System to STS

Source (Williams. I (2015))

The explanations so far are expressed in the figure above. The end result of the line of thought ends with the adoption of the Science and Technology Studies (STS) as seen in figure 5.1 above.

From the STS point of view, science and technology are actually social activities as scientists are members of the community (social community, cultural community, the scientific community, etc.) and not isolated from the community (Sismondo, 2011). STS explains how the material world (political, social, and cultural values) influence the scientist’s world and how scientific research and innovation influence culture, society and politics. (STSWIKI, 2009). The second part of the STS agenda, just stated fits into this report. This is because this report discusses how technology innovation (Broadband) influences universal service policies (politics) as a result of Public Private Interplay.

The boundary for this research here is based on the fact that this research is not focused on the innovation itself. Hence, innovation studies as well as Science, Technology and Innovation (STI) research fields are not applicable. That does not mean that it cannot be used in this research, rather it does not lead to answering the research question or fulfilling the aims of the research.

Hence, from this exercise, an explanation is offered towards how this research was narrowed down from the choice of discipline to the choice of field for this research. The next step was to search for a relevant descriptive tool from the STS and Organizational Studies sub-field. The result led to a theoretical triangulation.

5.2 THEORY SELECTION PROCESS

Having adopted the STS research field, the first step was to identify the theoretical perspective for this research beginning with this field. In the searching process, one had to take into consideration how the research questions would be answered. However, before choosing the theoretical approach to solving the problem, it was important to have a mental outline of how the problem will be solved.

The ultimate goal of the research was to identify PPI examples or inspirations that would aid in developing Broadband Internet Service in rural areas in developing countries. Sub-Saharan Africa is the point of departure here. In order to identify these inspirations, the sub-questions were related to certain countries in sub-Saharan Africa (Ghana and Nigeria). The emphasis of the PPI was to understand how it (The PPI) would be organized and funded. Hence, it was important to first understand how current PPIs are facilitated in Ghana and Nigeria. It was also important to identify the current PPI efforts to see how far these countries have gone into the process of facilitating rural Broadband Internet Access. The strong points, weak points and potentials would be noted in order to identify areas that needed improvement.

In the bid to solution to areas that needed improvement, a study was made in other countries around the world to find out if they have the same problem and what is being done using PPI to solve it. These countries would serve as the primary case study. Once this process is completed, it was important to analyze the results from the primary and secondary cases and the use the factors identified to discuss new ways PPI were being facilitated towards enhancing Universal Access and Service. From the primary case study results one can plug the holes -so to speak- on the lapses realized from the secondary cases. At the end of the analysis, How the PPI will be organized and financed would be clear. This would then help in answering the main question.

In the secondary case studies, the institutions responsible for Universal Access and Service in countries were identified as well as their activities. In Ghana, it was realized that there was a defunct rural wireless internet group, who once had an NGO facilitated Community Based network. Hence it was important to find out what happened. That would create an idea of the challenges they faced. This bottom-up initiative was part of the primary case study. The other cases in the primary case study consisted of the Hallaryd Broadband Coop (Sweden), the Magnolia Road Internet Coop (USA), Johannesburg Wireless User Group (JAWUG), DjurslandsNet (Denmark), Dharamsala Wireless (India) and the Almhult Municipality Broadband Initiative (Sweden).

Once the outline for the research was done, it was important to choose a theory that will aid in explaining the current sociological relationships between the Universal Access and Service institutions and the stakeholders that did aid them in carrying out their functions. In the case of the defunct Wireless Internet Group (bottom-up approaches), explaining their current circumstances was not relevant, hence it was important to adopt a theory that will explain, how they were formed, the various interactions as well as how they ceased operations.

One of the most important criteria for choosing the primary cases was that they actually exist in rural areas of their countries and are still functional. This was because lessons surrounding their longevity were necessary for discussing the organization and financing of the secondary cases. However, the policy of the functional existence of the case was dropped one, Ghana Wireless Project was identified. Hence the same approach used for describing the rural wireless user group was deemed sufficient, if and only if, the theory used for the defunct wireless user group in Ghana can support existing rural initiatives.

Finally, in search for a theory, it was important to identify either a theory or a tool that would provide a scientific link between the findings from the field, the described cases based on the theoretical framework and the content and context of the discussion. This analytical tool would aid in providing clear rationality and minimize plausibility when discussing the findings. The clear question a reader would ask would be, why not use an analytical, theoretical framework from start to finish? This was considered, however, due to the exploratory nature of the research, it was important to use a flexible theoretical triangulation approach.

The theories chosen were the Actor Network Theory for the retrospective understanding of the primary cases as well as the Wireless Ghana Project, the Stakeholder Theory to understand the present relationships in the universal Access and Service ecosystem in Ghana and Nigeria and finally, Grounded Theory to distill the facts and make a case out of the primary case. The search for the theory was conducted in the domain of the STS and Organization studies. Grounded Theory was used only for analysis of the qualitative data.

5.2.1 CHOICE OF ACTOR NETWORK THEORY

In the search for STS theories, the following STS theories were identified. These included, the Actor Network Theory, Co-production of Science and Social Order, Ethnomethodology, Social Construction of Technology, Sociology of Scientific Knowledge and Technology Dramas (STSWIKI, 2009). They are explained in the table below.

Table 5- 2 Some STS Theories

Theory	Explanation	Relevance	Reason
Actor Network Theory	It is a theory that maps relations between actants (both material and semiotic) and explains from a retrospective point of view how these actants come together as a network to act as a whole. With the concept of translation, it explains the networks transformation process and the power relations.	Yes	It relates to the research question as it can be used to study as well as analyse the network between the Public and private sector. Here one would see how the cases being studied are organized and the transformation process. It also fits into the four parameters
Co-production of Science and Social Order	It explains the mutual establishment of techno science and social order	No	It does not relate to any part of the research question
Ethnomethodology	It explains the ways social order is produced as a result of how people make sense of the world and display their understanding	No	Although social order is relevant to the research, the aim of the research is not to identify ways of studying or creating social order
Social Construction of Technology (SCOT)	SCOT stresses the importance of understanding the social context that facilitates the failure or success of an innovation as a means of knowing whether successful innovations worked better than the failed ones	No	The thesis is not aimed at examining the social context of an innovation
Sociology of Scientific Knowledge (SSK)	It offers social explanations to successful or failed science	No	It does not relate to any part of the research

	theories		question
Strong Programme	An extension of SSK which does not theories into failed or successful theories but treat them equally.	No	It does not relate to any part of the research question
***Technology Dramas**	These are technological statements and counter statements in which the process involves technology regularization, technology adjustments and technology reconstitution	No	This is not related to the research as the focus is on the technical culture, social values , aesthetic ethos and political agenda of technology designers

Source (STSWIKI, 2009) *Source (Pfaffenberger, 1992)

From Table 5.2, the Actor Network Theory is chosen as it fits into the research question as well as works both as a narrative and descriptive analytical tool using the concept of translation (network formation). It provides a retrospective look to the formation of actor networks. Most importantly the Actor Network Theory exposes the actions of the Actor, giving room for understanding of factors that led to the actors' actions. Hence, in this case one does not only understand the network, but the underlying tensions and alliances beneath the network. In the case of a PPI, one can identify the actual resource the public and private sector contributed to the sustainability of the network. If no PPI occurred, one would also understand why it did not occur and that would serve as a flashpoint which may be discussed with respect to the primary cases.

However, before adopting the Actor Network Theory, it was important to find out from other fields in information systems and information science to see if there are other theoretical frameworks that could be used to understand retrospective events before making a choice. Larsen et al (2014) from Brigham Young University UTAH, USA has developed a list of 85 IS theories (Larsen, Allen, Vance, & Eargle, 2014). After reading through each of the theories, Actor Network Theory, Agency Theory, Social Network Theory was chosen.

The Agency Theory was considered as actors or stakeholders could be agents. It was a promising theory as one could analyze the problems that exist between the principals (stakeholders) and agents (managers) in an organization. Although the theory can be used to analyze past events, the theoretical considerations do not include narrating what brought the principal and the agent together. The theory was finally dropped because, although it dealt with relationships between the principle and the agent and it had no room for technology as an agent (Larsen, Allen, Vance,

& Eargle, 2014). In the case of PPI the principle could be the public agency and the agent could be the private sector and vice versa. However, one could only use this theory when discussing external relationships between the Public and Private sector. However, when one decides to analyze the community networks, who are mostly democratic in nature, it is difficult to extend the principle-Agency theory to this domain as the risks in the organization is not the only concern of this report. Finally, despite the positives of this theory, it does not answer the research question of how the PPIs are arranged in our context.

The Social Network Theory was also a very promising theory of this research as it explains the relationships between actors (individual or networked nodes) (Larsen, Allen, Vance, & Eargle, 2014). It can be used to determine power relations as well as understand power relations within the network as well. However, if one is to analyze the transformation process of a node (In this case a group of individuals) - that is how was this node created- it is difficult to do so as Social network theory is not retrospective in nature. Secondly, the theory leaves little room for individual agency; hence it is difficult to see the role of the individual in the success of the network, unless the individual is a significant node itself (Larsen, Allen, Vance, & Eargle, 2014). Thirdly, the theory does not give room to the influence of non-human actors in the network.

The Actor Network Theory is able to take care of the deficiency of the Social Network Theory at the individual level in a sub-node with the concept of depunctualization. Here a black box could be broken down and the internal actors analyzed. Secondly, the Actor Network Theory gives room to the role of semiotic (concepts) and non-human actants. When discussing PPI, actancts such as ideas, legislation, and other non-human 'players' are important as they can decide whether a PPI could occur or not. Most importantly ANT is a reductionist and relativist theory (Latour, 1996). It is reductionist in the sense it aids in analyzing an epiphenomena. Epiphenomenon is a phenomenon that can be explained in terms of its relationship with other more fundamental phenomena. It is relativist as the networks do no present absolute truth or validity. The truth for each actor network is relative. The acceptance of the concept of non-human actants for this research stemmed from the believe that there could be other catalysts aside humans that facilitated or worked against some PPIs. It was important to know them (anti PPI actants) as well as include them in the discussion. If these provisions did not exist in the ANT, the context of this research would change as the Social Network Theory would have been adopted.

The delimitation in the search of the theories was that Computer science and Information Technology were left out. This is because most of the models and theories here are inclined towards positivism whereas this research is interpretivist in nature. One would say that the Social Network Theory is adapted from Network Theory in computer science. Although that is true, the social Network Theory is a framework that can be used to understand social relations without having to make some computations as in the case of computer science or IT. However, in this report, it was not relevant. Actor network Theory was chosen.

In this report, Actor Network Theory is used to retroactively trace the human and non-human interactions in each of the primary cases. The outcome is to identify how the organization and financial arrangement of the primary cases came to be. The retroactive tracing also enables the emergence of PPIs and how the relevant actors worked together to facilitate universal access in their communities.

5.2.2 CHOICE OF STAKEHOLDER THEORY

In the process of this research, it was important to understand who the public and private stakeholders were and how the 'Stakeholder ecosystem' is managed for the purpose of developing Broadband infrastructure. The Actor Network Theory is deficient in this area, hence the Stakeholder theory was adopted to complement this deficiency. This deficiency led to the search of theories under Organizational study. As mentioned earlier, the collective behavior of individuals in a group or organization constitutes organizational behavior. If an organization could be seen as an actor evoking an action of some kind, a coordinated action could point to some form of management, and an uncoordinated action could indicate the lack of management. Management in this case does not imply an entity, but an activity. Based on this line of thought, it was perceived that, in order to understand stakeholder management, it had to be identified from the organizational management point of view. Hence the questions were: who is managing the Universal and Service ecosystem in the countries where the secondary cases are domiciled? Which of the stakeholders are important to them and which of them is not important to them (universality fund)? To get the answers to these questions an obvious theory was identified and that was the Stakeholder Theory.

It should be noted that other theories would have been considered if the Stakeholder Theory was not enough. The Stakeholder Theory was initially designed to study how organizations, and corporations managed their stakeholders (Freeman, 1984). In this report, although the discussion is not about corporations one would say that the Community Based networks are entities that deal with both internal and external stakeholders. The same can be said of the public sector entity (Universality funds) on the other end. However, with the Stakeholder Theory, it is important to understand which stakeholder is important to the Universality funds in Ghana and Nigeria and which of these stakeholders was not important in to the respective universality funds. It is also important to see how these stakeholders are managed by the selected universality funds and the lessons that could be learnt from each case.

The identification of this theory provided the opportunity to describe the institutions in Ghana and Nigeria. Stakeholder Theory is also used as a tool in this report to identify how the public and Private Sector institutions in the secondary cases relate to each other to facilitate telecom and Broadband infrastructure.

This theory is complementary to the actor network theory because one cannot use the Actor Network Theory without identifying the stakeholders or actants (Actors). Secondly Actor network Theory is able to expose the shift in power relations once there is a shift in the equilibrium of an existing network. However, the ANT does not necessarily portray how the network was managed through the translation process. But the Stakeholder Theory does. In this manner, the Stakeholder Theory acts as a buffer for ANT in this regard as well.

The approach of combining Stakeholder Theory with the Actor network Theory is not new (See (Pouloudi, Gandecha, Atkinson, & Papazafeiropoulou, 2004)). The approach involves the adoption of non-human stakeholders in stakeholder theory as well as the combined usage of each theory. The discussion of the latter is centered on the inclusion of non-humans as stakeholders in organizations. In this manner a non-human actor in the natural environment, systems, living and non-living components can be considered as stakeholders in an ecosystem (Starik, 1995). Starik's (1995) rationale for expanding the scope of stakeholders is that the organization can be affected by these non-human entities.

Supporting Starik's view, Luoma-aho & Paloviita (2010) argue that the Actor Network Theory analyzes non-human stakeholders that would be useful when using the Stakeholder Theory as Stakeholder Theory does not take into consideration non-human actors. They christened their concept Actor-Networking Stakeholder Theory. The essence of their argument was that the actors of the corporate environment have expanded beyond humans to include 'technologies, political agendas and infrastructure' (Luoma-Aho & Paloviita, 2010).These entities now interact and are indispensable to corporations today. To make a deeper connection between Stakeholder Theory and the Actor Network Theory, Vidgen & McMaster (1996) made the argument that Information Technology in an organization is a non-human 'blacked boxed' actor which cannot be separated from the human actors that perform the organizational work as both, once present in an organization play a role in the overall operations of the organization.

The proposition of merging the Actor Network Theory and Stakeholder theory has not gone unopposed. There has been counter arguments towards accepting non-human stakeholders in Stakeholder Theory. Poloudi (1999) argued that there is no clarity in the identification process for non-human actancts in Actor Network Theory. Hence, it may be difficult to describe a non-human actants if it is treated as a black box. She also noted that it is problematic to perceive the voice and interests of non-human actants (Pouloudi, 1999).

In this report, there is no merger of the Stakeholder Theory and the Actor Network Theory. The reason for not merging the two theoretical approaches is because both of them do not have universal analytical frameworks. Their usage is case-based and their non-universal frameworks vary. Hence, if an attempt to merge both theories is embarked upon, how would one account for its universality in analyzing networks. Having made that point, it is important to note that nothing is wrong in accepting non-humans as stakeholders in Stakeholder Theory. Having provided the rationale for choosing the Actor Network Theory and the Stakeholder Theory, it is important to present an overview of these 2 theoretical perspectives.

5.3 OVERVIEW OF THE ACTOR NETWORK THEORY

The Actor Network Theory (ANT) was developed by Bruno Latour and Michel Callon in 1981 with subsequent inputs by John Law and Madeleine Akrich (Costa & Cunha, 2009). It is also known as Sociology of Translation (Latour, 2005) (Law, 1992). The theory comprises of a dissimilar family of “material-semiotic tools, sensibilities, and method of analysis that treat everything in the social and natural worlds as a continuously generated effect of web of relations within which they are located” (Law, 2009). It has been identified as an enrollment theory and a sociology of associations (See (Plesner, 2009) (Crawford, 2004) respectively). In another case it has been identified as a theory that is concerned with objectives that either “matter of fact” or “matter of concern” (Bryson, Crosby, & Bryson, 2009).

The theory is a socio-technical theory that explains from a more general perspective that it is impossible to understand the pillars that supports the functioning of society without taking into consideration “the facts manufactured by natural and social science and the artifacts designed by engineers” (Latour, 1996). In this manner ANT abhors the separation that separates science and society. Rather the relationships and associations within an actor network are viewed in a holistic manner. Here Latour (1993) points out that if the set of relationships- individual, natural, scientific, social or a combined set of these relationships- are to be studied, then every component, humans and nonhumans are indispensable actors as to how the phenomena exists in its current form.

From this point of view, ANT has been used to study innovations. ANT position towards innovation is not different from the theory’s general outlook towards associations. ANT identifies that innovative processes, technical decisions contribute to defining social groups concerned (Madeleine, Callon, & Latour, 2002). From the ANT point of view innovation is not just as a result of a pure technical process, as the society by which the innovation occurs plays a role in shaping the outcome of the technology (Law, 2009). To expand their argument they argued that inventions which evolve into innovations are patiently constructed via the collective activity of the actors as market and technology interacts leading to heterogeneous networks.

Hence the pillars of the theory are the actors whose existence and interactions, alliances and associations inscribe a network. This concept of the network is different from the conventional understanding of scientific, technical and social networks. The theory aid in to “retrospectively interpret, structure and present” how the events that led to an existing network occurred over time (Rodon, Pastor, & Sese, 2007).

5.3.1 NETWORK IN ANT

In the last paragraph of the beginning of this section, what is meant by a “network” in ANT was explained. However, how was this concept derived? The reason behind ANT’s network concept was explained by Latour (1996). Latour explains that for socio-technical considerations to be made, and then our society and the elements thereof can only be understood “through a network-like ontology and social theory”. The network-like ontology is not different from our conventional understanding of networks. But the idea of a network with respect to ANT is not conventional. The network idea, according to Latour (1996) was inspired by the French Philosopher Diderot, who used the word “réseau” (network) in his description of matter and bodies to avoid the distinction between matter and Spirit. Diderot’s perspective of including semiotics in his “réseau” implied that a network need not consist of material alone, but the unseen, such as concepts (semiotics) and non-humans. These semiotics and non-human actants are nodes that make up the network – in conjunction with human agency- by reason of alliances and association for the purpose of achieving a common or shared goal. Therefore the actors, both human and non-human make up the structure of the network. In other words, one would say that actors are the actor network (Oppenheim, 2007).

This mix of material and semiotic actants is the reason why actor networks are heterogeneous (Crawford, 2004). Latour calls this creative mixture that consists of nature and cultural (society) actors, hybrids (Latour, 1993). Hence actor networks are heterogeneous in nature and they are also known as hybrids. The existence of these hybrids presents no distinction between agency and structure as the network structure is determined by the actors (agents) or hybrids and positioning of the agent (Crawford, 2004). Hence, from an ANT perspective, whenever actors form a certain kind of association aimed at fulfilling a certain purpose, then that is a network. Based on this standing, ANT is an attempt to build a social theory out of networks and not vice versa (Latour, 1996).

Hence, with its network-like ontology and the social theory attribute, the ANT can be used to describe the web of interactions around us (Murdoch, 1997) (Law, 2009) as well as retrace the evolution of a perceived network (Callon, 1986). In this manner one can use the theory as a lens to understand in retrospect, structure and present empirical data from a narrative that revealed how an event occurred (Rodon, Pastor, & Sese, 2007).

Actor Networks are mostly local, variable and dependent or contingent as the nodes of the network are semiotically derived (Crawford, 2004). Despite the instability of actor networks, they have certain desired properties. Crawford (2004) identified the ability to juxtapose elements, translate or convert network elements and the search for network stability to be some of the desired properties of actor networks. Having understood what is meant by a network in ANT, it is important to identify the characteristics of the actors in ANT.

5.3.2 ACTORS IN ANT

The agent of change in an actor network is called the actor or actant (in the case of non-human actors). The range of what could be considered as an actor in an actor network is infinite. This is because the actor network is made up of indeterminate or undefined actors, that could be anonymous, ill-defined or indiscernible (Callon, 1999). Law (2009) as mentioned earlier identifies the characteristics of actors to include material and semiotic characteristics. ANT's acceptance of the semiotics is based on Foucault's assertion that "strategy is not necessarily located in human deliberations" (Law, 2009). Some examples of semiotic actors include textual, identities, relations, inscriptions and even networks that can be punctualized in a bigger network and conceptual actors (Crawford, 2004). The material actors include humans, technical and social actors. Social actors could also be semiotic (Crawford, 2004). Latour (1996) provided a much broader set of classes of actors that encompassed both material and semiotic actors. The set human, unhuman, nonhuman and inhuman (Latour, 1996).

Examples of actors identified in ANT studies are:

- Michael Callon's study on the domestication of the scallops and the fishermen at St. Brieuc Bay (Callon, 1986). Here the actors involved were human and non-human actors. The human Actors were the 3 researchers conducting the research, the St. Brieuc Bay fishermen and the scientific colleagues of the researchers. The non-human actors were the Scallops.

- In Latour's study of the Pasteurization of France, Microbes were regarded as an actor in the Actor network, even though the idea was to eradicate the microbes or contain it, the human actors were Pasteur, his followers, hygienists and doctors in the army and in the tropics and civilian France (Latour, 1993) (Vernon, 1990).

The question that crops up include questions that have immediate answers and questions that have answers hanging. Let us start with the one with an answer from Latour. Why are non-human regarded as actors? The criteria for determining an actor in ANT is situated in the agency's action or ability to act or induced to act

(Latour, 1996). Hence, in this manner, anything or phenomena could be an actor in an actor network, hence making the actor either material or semiotic.

However, there are others with not so clear answers. An example is: why these diverse range of actors? The answer, as mentioned earlier is because you do not have to purify science and society. In this sense the causality for action will increase. This then leads to another question whose answer is not clear in ANT.

Agreed that it is important to take into consideration the importance of nature and society as a whole, but are all identifiable inhumans, non-humans and unhuman actors really actors in a particular network? If no, what separates the actor from the non-actor and what makes that actor indispensable to the network? Where is the limit? These aspects of ANT are not clear as one would often see certain non-human actors left hanging. An example is Callon’s exclusion of the water where the scallops were domiciled. Could either its acidity or alkalinity affects the scallops as well? That is food for thought. However, in ANT the human and non-human actors are given symmetric (equality) treatment as each actor identified in a network is believed to be important and probably indispensable to the network. The symmetric treatment is given for the following reasons:

- If the actor (human or non-human) does not exist, then the network would not be the way it is at the moment.

- Each Actor or actant (non-human) possess inherent interests and motives as they view the network that requires accommodation and negotiation (Latour, 1993). For non-human actors, Latour (1993) explains that their interests and motives are non-verbal, but the existence of the non-human actor raises questions, such as “what do they want?”, ”what do they do?” etc. However it is these interests and motives that guide the actor’s decision to be or not to be a part of the network. It is also this interest allows the actor to act alternately and indiscriminately, whether the actor is “a power that enrolls and dominates or an agent with no initiative that allows itself to be enrolled” (Callon, 1999).

The importance of the actor and actants in ANT is quite high because actor networks are networks of action. At the center of the action are these entities (actors and actants). As these actors and actants interact, the heterogeneous amalgamation of these actors in a network makes the actor network unique, unstable and constantly evolving. The evolution is as a result of the evolution of the actors (agents), its social order and organization (Law, 1992). As a result of these factors, Law (1992) explains that the actor networks are never completely autonomous or final. The network evolution and its impact on society and nature make the study of these networks around us important. Hence the role of ANT has been to lead to the understanding of how these heterogeneous interests align and are embedded into technologies that stabilize the network (Callon, 1991).

5.3.3 MEDIATORS AND INTERMEDIARIES

One major characteristic of actor networks is power relations. As actors interact in the social space, some are bound to impose themselves on the others. Law (1992) identifies this possibility in the networks and identifies that power relations are generated as the actors relate with each other. This leads to order struggling until a compromise is struck among the actors. Unlike other social organizations, there are no center of power in ANT. Based on this fact the actor network evolves as power tilts within the networks. There are two sets of actors or actants who exert some form of influence in actor networks are identified. They are the intermediary and the mediator.

INTERMEDIARY

The intermediary is an actor that connects two or more actors in the network and translates the action of one actor to the other (Kaghan & Bowker, 2001). Latour 2003 identifies the intermediary as an actor that acts as a channel of communication between two actors. The intermediary is "what transports meaning or force without transformation" within the network (Latour, 2005). Kaghan & Bowker (2000) explains that intermediaries help the connected actors "improvise" responses that are both sensible and acceptable to their circumstance. They further explained that the intermediaries help in the process of negotiation between the actors and that in many cases intermediaries help in connecting two or more black boxes or punctualized actors in a network. Intermediaries are believed to transform nothing in the network as they transport the force-Latour mentioned earlier- of other entities (Plesner, 2009) (Bryson, Crosby, & Bryson, 2009). They possess unidirectional passive and predictable channel or stream of influence on the actors as the" defined inputs of the intermediary are enough to determine their defined output" and the count only for one or for nothing (Latour, 2005).

An example of an intermediary is strategic planning in a business or government organization (Bryson, Crosby, & Bryson, 2009). Bryson, Crosby & Bryson (2009), identified "Specified process steps, strategic planners, communication processes, SWOT analysis, stakeholder analysis and many other semiotic actors' as members of the strategic planning black box- strategic planning. Hence rigid strategic planning in an organization transports a cause from input to output without changing in itself. In this case it provides a roadmap as negotiated by the relevant actors between the current states of the organization to the expected goals of the organization. Strategic planning here outlines the vision and plans of the management actors as well as provide assignment as to how the actors in the organization will respond to each role - as negotiated earlier within "strategic planning's" black box- to aid the management achieve their desired goals. In this manner the action of one actor is translated to the other within the network. Strategic planning can also be a mediator as discussed in the next under the title "mediator".

In this research an identified intermediary can be seen in the case of MRIC (a primary case) in the USA, where Tim Plant – the state representative - acted as an intermediary between MRIC and the state. He was the channel for state funding (a non-human actor). An example of a non-human intermediary from another case is the municipality funding (a non-human actor) in the case of Almhult municipality and Hallaryd Broadband Coop in Sweden. Municipality funding was uni-directional from the municipality to the coops. This funding was one of the main reasons the coops decided to partner with the municipality. It also provided one role which was to supplement Broadband infrastructure development funding. Municipality funding also serves as a mediator as explained in the next point.

MEDIATOR

The mediator just like the intermediary connects two or more actors in the network, but it does not translate the action of one actor to another. Rather, they offer occasions, circumstances and precedents that are needed for deliberation, action and association (Latour, 1993) (Latour, 2005). Latour (2005) mentions the possibility of mediators being many, who may influence no actor association, one, several or infinite actor associations. He further explained that the input of the mediator does not define its output. Hence a mediator is dynamic, multi-directional, and an unpredictable conduit of influence to the actor network.

These classifications are not tagged on particular actors, but denote the actions of an actor at any point within the network. For example, an actor could be an intermediary in a particular circumstance or a situation and then become a mediator in another situation either as a result of displacement, diversion or redundancy (Bryson, Crosby, & Bryson, 2009). In further explaining the unstable characteristic of an actor either as an intermediary or a mediator, Latour (2005) points out that the difference between the intermediary and the mediator is subtle.

An example of this subtlety can be found in the case of strategic planning in an organization, mentioned earlier. In the case of developing strategic plans as mentioned earlier, the process of developing strategic plans may not necessarily be straight forward as it could be either static and predictable or dynamic and unpredictable. Bryson, Crosby & Bryson (2009) explained that strategic planning is not a rigid process but complex and unpredictable. This implies that strategic planning efforts could fail, leading to an iterative effort in producing a strategic plan. In the process of the iterations, actors learn from each other, some actors could disagree to the plan based on the difference in their cognitive, behavioral and political inclinations (Bryson, Crosby, & Bryson, 2009). Hence there are tweaks in the vision and purpose of the strategy as the actors learn from each failure as they try to develop a strategy. Hence a rigid strategic planning is an intermediary, but dynamic strategic planning is a mediator as it keeps transforming itself.

An example of a mediator is an RFID chip, as this non-human actant has changed the way organizations relate with computers and with RFID enabled devices. RFID enabled devices and computers enable mobility of the human actant as well as remote connectivity. Hence, in this manner, RFID's influence on existing network between computers and humans in an organization alters the state of the stationary human-machine interaction to a mobile human to machine interaction. The conduit of influence of the RFID chip is unpredictable will continue to change with respect to human machine interaction as the studies on censors continue.

As mentioned in the previous point, municipality funding and other forms of state funding were also a mediator. Although their basic function was to provide funding possibilities, it changed the way Broadband and ICT infrastructure was being developed. The funding also served as an incentive for rural dwellers to invest in the Broadband infrastructure. Mini-implementation failures were also intermediaries as will be seen in chapter 9 for the developing country cases. These failures led to iterations in trying out new ways of solving the problem until it was solved and people were interested to join the coop –hence mobilization. An example of a human mediator can be seen in either the coop initiators or individuals. Their attempt to change their reality led them to connect non traditional allies' together, people and telecom technology. This led to the formation of actor networks, thereby connecting two or more actors together and giving room for intermediaries and sub-mediators to send the quasi-tokens to facilitate action in the network.

5.3.4 CONCEPTS OF ANT

The identifiable concepts include Punctualization, Black-boxing, Inscription, quasi-object and the ANT's core concept of Translation.

Punctualization: In ANT is the process where a network becomes an actor or acts as a single entity within another network (See (Law, 1992)). An example is an external look at a national government, where the different ministries and department reporting directly under a central government are seen as actors to the Government. The ministries are networks of themselves with different agencies and they have a minister or any other Government official as their spokesperson in relation to the central government.

Black Boxing: In ANT is the process of punctualizing. One would say that the process in which an actor network is being formed through "the assembly of disorderly and unreliable allies into something that resembles or organized as a whole is called Black boxing (Rodon, Pastor, & Sese, 2007). In this thesis, one would call the Public and Private sectors in their individual domains, black boxes.

Inscription: In ANT is a process whereby the translations of an actor's interest are embodied in technical artifacts (Rodon, Pastor, & Sese, 2007).

Irreversibility: In the ANT presents the overall resistance of an actor network against change (Rodon, Pastor, & Sese, 2007).

Quasi-Objects: In ANT are conceptual objects (non-human items) or fabricated objects that exist between the poles of nature and society (Latour, 1993). Latour explains that these objects are real, non-human and objective. These objects are tokens transmitted within the actor network in the form of interactions that exist within the network as translation is explained. According to Latour (1993), these quasi objects are hybrids of soft objects (conceptualized by nature or society) and hard objects (material scientific objects or artifacts) hence forming the missing link connecting the non-human item and the person. The basis for Latour's hybridization exercise is based on the fact that neither the social nor the scientific factors can single-handedly explain the final form of a punctualized network. These hybrids are real, social and discursive (Frohmann, 1995). Frohmann (1995) listed an example of radio broadcasting serving as a hybrid or quasi-object in the construction of the information superhighway. The scientific elements or the hard elements of this punctualized quasi-object are tubes, wires and transmitters (Frohmann, 1995). Frohmann (1995) recognized the soft elements or the social elements to be "the class difference between producers and customers, the interests of large corporations, the concentration of capital for the accumulation of profit in broadcast media". Based on these properties' the radio is hybrid.

Translation: In ANT is the "local process of partnering, social orchestration, ordering and resistance" that occurs as an actor network is being formed and possibly evolve further (Law, 1992). It is the core concept of ANT (See (Crawford, 2004) (Callon, 1986) (Latour, 2005) (Law, 1992)). Translation is a form of social ordering. Law (1992) explains that the process is concerned with how "the actors and organizations mobilize, juxtapose and hold together the bits and pieces for which they are composed". Latour posits that the end product of translation is hybrids (networks).

5.3.5 PROCESS OF TRANSLATION

The translation process is not universal as some actor network theorists have developed a different circumstantial path to which they believe exposes the trajectory of the translation that took place. John Law identified a strategy for translation. He did not identify this strategy as a general strategy. Here, Law (1992) explains that although all actors are equal, not all of them are durable, hence cannot maintain long relationships with one another. So he begins the translation process with:

- Relationship mapping to select actors and actants that have the tendency of having long lasting relationships. This mapping process is vague and subjective.

- If the relationships are deemed durable, then mobility through space is explored.

- Here one looks at the processes of communication between the identified actors

Translation is said to be in progress if the actors react and respond to and fro with the material of communication used by the different actors. It is this outcome of the negotiations that would result in the social order that emerges as an actor network

In 1986, Michel Callon also carried out a retrospective study of how three scientists, who learnt scallop harvesting techniques in Japan, brought the idea back to France (Callon, 1986). Their idea was the starting point of scientific knowledge in scallop development, and it led to the extension of this knowledge to fishermen in the St Brieuc Bay in France who used the Japanese techniques to sustain their scallop trade. In this manner an actor network was formed between three black boxes, the three scientists, the scientific community, the St. Brieuc bay fishermen and the scallops themselves.

Callon (1986) identifies four phases of translation: These are namely Problematization, interessement, enrollment and mobilization.

PROBLEMATIZATION

This is a stage where alliances or associations are formed based on the interests and motives between the different actors, thereby defining the identity of the perceived actor network. This involves 3 stages:

Problem identification: Here the Primary actor tries to solve the problem by approaching it in the form of a critique. An example in Callon (1986) case was: “is this experience transposable to France and more particularly to St. Bruiec’s Bay?” The critique could be a series of questions.

Interdefinition of actors: Then primary actor then defines who identifies who would be needed to solve the problem based on their inherent interests and motives.

Setting an Obligatory Passage Point (OPP): The primary actor outlines the problem and the proposed plan of action and convinces the other actors that this is the way to go and they (the primary actors) know how to get the work done. In this manner, they negotiate with other actors to follow their plan. This makes the primary actor indispensable thereby giving them control over the process and the group. Hence the process is the art of setting an obligatory passage point

INTERESSEMENT

Callon (1986) defines the concept as "the group of actions by which an entity attempts to impose and stabilize the identity of the other actors as it defines through its problematization." It is a process of recruiting the actors by creating interest and negotiating the terms of their involvement in the network (Costa & Cunha, 2009).

ENROLLMENT

This process involves the definition and coordination of roles to the entities identified. At this point the identified actor accepts the networks problematization and adopts the roles assigned to them (Costa & Cunha, 2009). Here the actors form the alliances and associations bestowed on them by negotiations and one actor imposing its will over the other as outlined in the problematization among the actors (Callon, 1986).

MOBILIZATION

Michel Callons idea here was to identify the spokesperson(s) for the network or punctualized actors. He cited some pertinent questions such as: Who speaks in the name of whom? And who represents whom? Once a spokesperson is identified, it is accepted, albeit temporarily that the actor interests are stabilized, controversy removed and translation is complete (Costa & Cunha, 2009).

Callon's (1986) identified framework of translation clearer than Law's (1992) mode of translation. It provides an analytical framework that aids in explaining social and technical phenomena. Callon's framework has been used extensively and in most cases seen as a recognizable framework for describing, explaining and analyzing actor networks (See examples (Rodon, Pastor, & Sese, 2007), (Reinhard & Macadar, 2006) (Costa & Cunha, 2009)etc.). This is the translation approach adopted for this report.

5.3.6 LIMITATIONS OF ANT

ANT can be abstract and fluffy: John Law did point out that ANT is abstract, it is not a theory as it is descriptive rather than explanatory, it is a diaspora that overlaps with other intellectual traditions as it explores the relational tendencies that exist in the world (Law, Actor Network Theory and Material Semiotics, 2009).

Lack of universal analytical framework: ANT lacks a universal sociology of translation framework. Although Callon's work is widely accepted, it is not the standard framework for ANT.

Unsure of whether it is a theory or an approach: The words Actor Network Theory and the Actor Network Approach interchangeably (See (Law, 1992) (Law, Actor Network Theory and Material Semiotics, 2009)). The fathers of the theory shy away from calling it a theory. Callon (1999) declared that they never claimed to create a theory. Law (1992) argued that theories are explanatory tools and not descriptive tools of analysis.

No clear path to recognizing relevant actors: As ANT provides the platforms for diverse forms of actors and actants within a network ecosystem how does one create a boundary to avoid an overflow of context under consideration. This is not clear as the applications of ANT from Michel Callons Domestication of the scallops to Latours pasteurization of France, there are non-human actors that were not taken into consideration by the authors. For example, in the case of the scallops domestication, Callon preselected the actors in the ecosystem and dropped the others. For example, the scallops lived in water. Of course scallops were the subject of the issue, but could the water have possessed some properties that making at St. Brieuc bay attractive for over fishing which would make the bay an actor in this discourse. On Latours piece on the war on microbes, depicting the 'war between France and Influenza in the pasteurization of France, he concedes that "We do not know who are the agents who make up our world" (Latour, 1993). Latour when discussing on Translation vs transportation conceded that although certain actors exist in a network that is observed, it may be difficult to create relationship between certain actors as it is difficult to decipher the emotions and intentions of non-human actors in the network (Latour, Reassembling the Social, 2005).

5.3.7 CRITICISMS AND REBUTTALS OF ANT

The following are few, but not all criticism of ANT. These are:

- ANT has been criticized for its adoption of materials and semiotics in analyzing networks (Vernon, 1990) (Murdoch, 1997).

- The symmetry between human and non-human actors (Murdoch, 1997). Vernon (1990) admitted that Latour's work in the Pasteurization of France was novel, but the account points to how the human actors solved the problem, but one wonders 'what the microbes thought about Pasteur's attempt to eradicate them' (Vernon, 1990). Murdoch (1997) posits that ANT undermines the divide between human and non-human actors, hence advocating equality or symmetry between both actors. Furthermore, he wonders if the acceptance of non-human actants provides room for critique, if one of the non-humans turns out to become a powerful actor.

- Others query if ANT is a theory and its analytical strength. In reviewing Latour's work on Pasteur, Murdoch (1997) also identified that ANT has practical universality problems as everything in life cannot be written in the language of networks and this presents practical problems in describing and simplifying the definitions of concepts surrounding agency.

However, the founding fathers of ANT have identified the same set of criticism and more and raised rebuttals to them.

<u>Bruno Latour</u>

Table 5- 3 Some of Latour's Rebuttals

	Identified Criticism	**Rebuttal**
1.	To include identifying networks from a technical point of view	Networks in Actor Network Theory are not just technical networks but a continuously evolving set of actor interactions within a space to fulfil a common purpose.
2.	ANT does not have much to do with the study of social networks due to its inclusion of non-human actors	ANT is not aimed at studying human relationships but to provide an account for the essence of societies and nature. ANT is aimed at describing the nature of societies, hence building social theory out of networks. This is why non-human actants are adopted as actors in the network because they matter in the grand scheme of things in society. He argued that social networks are aimed at providing information on human relationships in a social and natural world. He however conceded that social networks could be included in ANT descriptions.
3.	Mathematical or engineering networks are developed, traced or inscribed by another entity	In ANT, it is the network that traces itself and he further argued that the word network is an ontological definition and not "an inert piece of matter in the hands of others". It is the study of the nature of being of the network and the network in many cases already exists

		as it had created itself.

Source (Latour, 1996)

John Law

Table 5- 4 John Law's Rebuttal

	Identified Criticism	**Rebuttal**
1.	The studies are centrered, managerialist attending to the powerful	ANT is centralized pointing to network effects and de-centered discuss. He cited Latours work on Pasteur and his work on managers as examples.
2.	The approach obliterates anything that cannot be seen as a network, hence refusing to recognize ANTs role as an Intellectual technology of ordering	Most ANT studies take the bottom-up approach rather than the top to bottom approach adopted by historians.
3.	The ANT is not aware of its own politics and the political agendas of its own stories	He pointed out that ANT has “interest in the origin and constructions of its accounts”

Source (Law, 2009)

5.3.8 APPLICATION OF ANT IN BROADBAND DEVELOPMENT AND PPI

The ANT is a very popular theory; it has been used to study different forms of actors, stakeholders and entities in different areas of life and endeavor. In studying relationships between the public and private sector. These include the relationships between the public and private actors involved in the development of telecommunications policies, applications, services and infrastructure (see (Marta, Rowena, & Jocelyn, 2013) (Reinhard & Macadar, 2006) (Hess & Coe, 2006) (Skogseid & Hanseth, 2005))

These discussions have been geared towards other continents excluding sub-Saharan Africa. The reason for this is based on the fact that telecom development in Africa at the moment is in a large sense a private activity with little influence from the public sector. This fact adds a tint of novelty to this report.

The ANT has also been used to explain the development of Broadband in some countries - in both developing and developed countries. Some examples include Yoo et al's explanation of the evolution of mobile Broadband infrastructure in Korea, used the ANT (Yoo, Lyytinen, & Yang, 2005); the development of rural Broadband infrastructure in Norway (Skogseid & Hanseth, 2005); telecom development in Ghana (Williams, Adjin, & Tsivor, 2014); to mention but a few.

ANT has also been used to explain the use and adoption of telecom network application such as mobile money (Lee, Harindranath, Oh, & Kim, 2014). It has also been used to study why users do not accept the Broadband connectivity or use residential Broadband services in Canada (Middleton, 2002). There was also a study about the impact of Broadband Internet on the Kenyan Tourism sector (Waema & Katua, 2013).

The thread that runs through these studies among others is the flexibility that ANT provides towards the study of each Sociology of Translation. Secondly, ANT enables these studies as the authors now have room for non-human actors such as technology as well as texts such as policy documents and semiotics. In this manner they authors are at liberty to represent the ecosystem in a holistic manner. Finally the thread that runs through these studies is the diagnostic ability of ANT. As it is a 'retrospective' study tool in a sense, the authors could use the theory to understand what went wrong in the actor network and propose a way forward.

5.3.9 CONCLUSION

The actor network is an interesting way of understanding networks. One would say that the sociology of translation helps us understand how associations and alliances that are formed for a specific goal came into being. However, it is a very subjective network as each observer may have different motive and interest in studying a network, hence leading to different interpretations. The interpretations are not universal and are plausible. In this manner one would not be interested in studying a network to understand what a network 'says' but what the observer wants the network to 'say'.

One would say that ANT is a theory of identified and unidentified theoretical frameworks. An example of an identified framework is the Callon's sociology of translation. Rather than criticize the theory, it is important to identify how the theory is adapted in different disciplines and develop frameworks which could give birth to more frameworks. This will be a tall order, but it is not impossible. Having said that, it is important to note that it will be difficult to develop a holistic theory for ANT as society and nature continues to expand. In this report, there has been an attempt to list out the concepts in John laws, sociology of translation. Further studies into how ANT has been utilized could lead to the formation of a class of orders that can continuously evolve. As we all know; the atom is no more the smallest indivisible particle of matter anymore. Science gives room for an alpha and never an omega as the evolution of concepts and theories continue.

Finally, as mentioned in the earlier parts of this chapter, there is no acceptable definition of the word theory. However, every definition of theory points to relationships. ANT explains relationships. It digs deep and across interdisciplinary lines to extract forms of relationships. It does not attack disciplines, but dares to unearth how disciplines complement each other. This is novel and worth exploring further.

5.4 STAKEHOLDER THEORY

Stakeholder Theory was proposed by Edward Freeman in 1984. It was a discussion aimed at stressing the paradigm shift in the managing of corporations (Freeman, 1984). Here he argued that stakeholders (internal and external) had an impact on how the firm performs. Some external stakeholders included the Government (introducing regulations), corporate critics, the media,etc. (Freeman, 2010).

The central concept facilitated by the stakeholder theory is that of the stakeholder. The stakeholder concept is divergent in nature. This is because of the ever expanding classes of stakeholders identified for different purposes. Driscoll & Starik (2004), has classified these definitions into either Broad and inclusive or narrow and exclusive definitions.

Table 5- 5 Definition of the Stakeholder concept

	More broad	**Broad and Inclusive**	**Narrow and exclusive**
Description	Definitions that include non-human actants	Public relations or Moral focus	Managerial perception of stakeholder power, resource dependency or risk

Source (Driscoll & Starik, 2004)

In a broader perspective Vidgen & McMaster (1996) define stakeholders as '……any human or non-human organization unit that can affect as well as be affected by a human or non-human organization unit's policy or policies' (Vidgen & McMaster, 1996).

The broad and inclusive definitions include: A stakeholder is any group or individual who can be affected or is affected as an organization attempts to achieve its objectives (Freeman, 1984). Another view involves groups who are indispensable to an organization, which implies that without their support the organization will cease to exist (Pouloudi, 1999).

The narrow and exclusive definitions include: “An individual or group of individuals that asserts to have one or more stakes in a business” (Carrol, 1993)

The Stakeholder Theory describes or explains the type of relationships between organizations, their stakeholders, the processes and outcomes of these relationships for the organization and their stakeholder (Driscoll & Starik, 2004). Another way of looking at it, is the relationship of a firm with its external environment and its behavior or interaction with its environment (Key, 1999). The approach towards Stakeholder Theory has been diverse, deepening and blurry (Donaldson & Preston, 1995). Hence Donaldson & Preston (1995) made an attempt to identify the areas discussed regularly and the aspects of Stakeholder Theory often identified. They did posit that Stakeholder Theory could be blurry depending on how it is being discussed. This blurry nature is a product of the abstractness of stakeholder theory (Bailur, 2006). In other cases it is recognized as a research tradition rather than a theory as it does not possess any standard frameworks that can be used to validate the data gathered empirically (Treviño & Weaver, 1999).

5.4.1 GENERAL DESCRIPTION OF STAKEHOLDER THEORY

This section presents a deeper detail bordering on the aspects and concepts of the Stakeholder Theory. The headings of the deeper details include: the description of Stakeholder Theory, the rebuttal to these criticisms and examples of the application of the theory in the development of Broadband infrastructure.

Stakeholder Theory is a very divergent theory and hence the chapter limits the description of the theory to popular or widely used traditions of Stakeholder Theory. The theory description will be anchored on Preston and Donaldson (1995). This is because they were one of those who attempted to create order in the midst of chaos by classifying the core of Stakeholder Theories. They are widely cited and their identified core - even though not accepted by all - or often identified as Stakeholder Theories. There are other Stakeholder Theories which center on the relationships and power relations in a corporation. An example is the theory of stakeholder identification and Salience by Mitchell, Agle and Wood (1997) adopted in this research. However, they still sit on Donaldson’s and Prestons identified core classifications.

GENERAL ASPECTS AND CONCEPTS OF STAKEHOLDER THEORY

Preston & Donaldson (1995) identified four concepts used to discuss issues surrounding stakeholders in literature. These include the concept of the stakeholder, stakeholder management, stakeholder model and stakeholder theory (Donaldson & Preston, 1995). They argued that although these concepts are not mostly distinctly discussed, they differ as much as they relate.

Concept of the Stakeholder: Stakeholders are persons or groups with legitimate interest in the procedures and substantive aspects of activities going on in the corporation (Donaldson & Preston, 1995) .

Stakeholder Theory: They posited that the stakeholder theory could either be normative, descriptive or instrumental.

The Normative Stakeholder Theory is established based on the fact that the stakeholder interests are fundamental or of intrinsic value, hence each stakeholder deserves consideration for its own sake (Donaldson & Preston, 1995). In a nutshell, how should managers deal with stakeholders (Berman, 1999). Or what should be the moral compass that guides a manager's dealing with the stakeholder.

The Normative Theory is used to understand or interpret how the corporation functions. Here the "identification of moral or philosophical guidelines for the operation and management of the corporation" is carried out (Donaldson & Preston, 1995).. Some core concepts of the normative stakeholder theory are common good, doctrine of fair contracts, property rights, the principle of stakeholder fairness, risk, etc. (Phillips, Freeman, & Wicks, 2003).

The Descriptive Stakeholder Theory provides a model that "describes the corporation as a constellation of cooperative and competitive interests possessing intrinsic value" (Donaldson & Preston, 1995). The descriptive Stakeholder Theory is used to explain or describe specific characteristics and behavior in a corporation. Basically, it explains organization behavior (Bailur, 2006) or how managers actually deal with stakeholders (Berman, 1999).

The Instrumental Stakeholder Theory provides a model for examining connections or relationships between the form of stakeholder management (descriptive stakeholder*[3]) being practiced and how that has led to the pre-determined performance goal of the cooperation. Its central tenet is to understand "what happens if managers treat stakeholders in a certain manner" (Berman, 1999). This theory is often deployed after the descriptive theory to "identify the connections or lack of connections between stakeholder management and the achievement of traditional corporate objectives" (Donaldson & Preston, 1995).

Donaldson & Preston (1995) argue that the normative aspect of the theory supports both the descriptive aspects as well as the instrumental aspect, making these 3 different aspects, quite distinct, yet mutual. They argued that the fundamental purpose of stakeholder theory is to explain and guide "the structure and operation of the established corporation".

[3] Included in this report for clarity

The relationship between the three aspects of stakeholder theory as explained earlier is seen below.

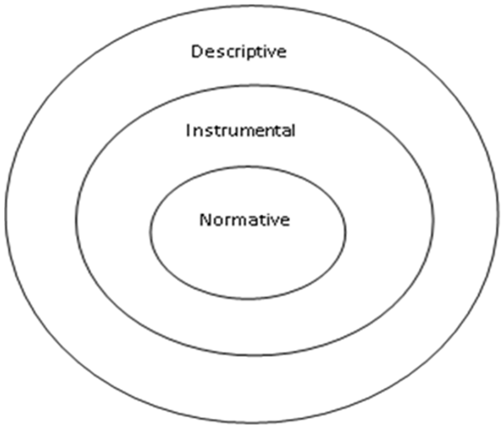

Figure 5- 2 ***Aspects of Stakeholder Theory***

Source (Donaldson & Preston, 1995)

Stakeholder Models: Stakeholder models are often used to explain stakeholder relations under Stakeholder Theories. Here, Donaldson & Preston (1995) argue that it is important to separate the different models used in describing stakeholder relations in other settings from that of stakeholder relations with respect to a corporation. To buttress their arguments, they explained that corporate stakeholder issues are unique to the corporate setting. The model adopted for this thesis is the Theory of identification and Stakeholder Salience by Mitchell, Alge and Wood (1997). This stakeholder model is still used to analyze cooperations, but in this report, it is used to analyze public authorities.

Stakeholder Management: Donaldson & Preston (1995) argue that the Stakeholder Theory is also managerial as the managers "… recommends the attitudes, structures and practices that when taken together, constitute a stakeholder management philosophy." Assuming that the Stakeholder Theory is just a descriptive observation showcasing that "organizations have stakeholders", then the theory will have no managerial implications. But if there is a shift from implicit function analysis to an explicit function analysis of the corporation using the Stakeholder Theory, then there has to be:

"The recognition of specific stakeholders and their stakes by Managers and other stakeholders".

"The role of managers and the management function, as distinct from the persons involved within the stakeholder model."

The reason they gave is because it is a managerial function to select corporate activities and to direct resources that would enable the manager to obtain benefits for legitimate stakeholders.

CRITICISM OF STAKEHOLDER THEORY

There are criticisms of the Stakeholder Theory even though there were attempts by some scholars to provide a unified framework for the Stakeholder Theory (See (Jones & Wicks, 1999)). Some of the general criticisms of the theory, among myriads of others, are as follows:

It is not a convergent theory: Although attempts have been made to classify stakeholder theory, there is no one single stakeholder model. The criticism of Trevino & Weaver (1999) was that most empirical stakeholder theories are developed based on specific cases; hence it is difficult to have a unified framework for stakeholder theory.

Not enough work has been done for a unified theory to be created: One reason for the theory not being convergent is because it is believed that enough work has not been carried out to enable the convincing combination of the strands of Stakeholder Theory to become one (Friedman & Mills, 2002). They based their reason on the inability of Stakeholder Theory proponents to identify who the types of stakeholders, to define which stakeholder is legitimate or not and the assumption on the boundaries of the stakeholder. The various forms of stakeholder theories do not necessarily reflect real organizations or corporations.

To explain further, descriptive Stakeholder Theory has been construed as not being realistic as the managers do not also act as if all stakeholders have intrinsic value (Treviño & Weaver, 1999). This is because from their example the managers value one set of stakeholders over the other and are open to a clear satisfaction of one set of stakeholders over the other. Their example had to do with employees being asked by managers to engage in unethical practices towards the customers. They further argued that, assuming the managers do value every stakeholder as having intrinsic value, it does not imply relationships and connections that ensue based on the form of stakeholder management would lead to better outcomes. In this sense they query the validity of the Instrumental Stakeholder Theory. From the normative point of view, managers are forced to give preference to 'high-power/high urgency stakeholder' while forsaking the 'low-power/low-urgency stakeholder.'

It is not a theory at all: Key (1999) concedes that due to the complexities of social systems, it is difficult to model theories that can exactly mirror reality. She further suggested that it is not possible for a theory to exist without values, causal laws or concepts that explain the phenomena. She argues that the theory lacks:

- Adequate explanation of process.
- The incomplete linkage of internal and external variables.
- "Insufficient attention to the system within which business operates and the level of analysis within the system".
- Inadequate environmental assessment

Hence, based on the broken link in universal values or causal laws, as most stakeholder theories are case specific, the theory lacks the explanatory logic for the relationships that are being observed. She sees Stakeholder Theory as an extension of the theory of the firm.

REBUTTAL TO CRITICISM

To counter these criticisms, Philips, Freeman and Wicks (2003) decided to create boundaries around the theory. They agreed that the concept of the stakeholder was divergent and ambiguous in nature. First, they reiterated what Stakeholder Theory entails. These include (Phillips, Freeman, & Wicks, 2003):

- Theory of organizational management and ethics.
- The theory addresses the moral values as a central feature of organization management.
- To maximize shareholder wealth, stakeholder theory provides equal attention levels to every stakeholder (beneficiary or otherwise)

In identifying what stakeholder theory is not, they grouped the misconceptions into two categories as seen below.

Table 5- 6 Rebuttal to Criticism of Stakeholder Theory

	Critical Distortions	**Friendly misinterpretation**
1.	It is an excuse for managerial opportunism	The theory requires change to current law.
2.	It cannot provide the exact function of a corporation sufficiently	It is a "socialism and refers to the entire economy"
3.	The theory is about "the distribution of financial outputs"	The theory is a "comprehensive moral doctrine"
4.	It establish that all stakeholders be treated equally.	"Stakeholder theory applies only to corporations"

Source (Phillips, Freeman, & Wicks, 2003)

Although the rebuttal seems to streamline the theory, it does not actually satisfy the curiosity of the criticism raised in this chapter. It makes the theory a bit vague as a roadmap on how to study the moral values are still non-existent. Although there is this perception that all stakeholders are not equal, how every stakeholder would be catered for, if they are not granted any form of parity in dealing with the stakeholders by the manager?

However, one would say that the Stakeholder Theory provides a mental outline with a blank checked set of values in which the researcher is free to determine in what way or manner the stakeholder relationship and management can be analyzed.

In this thesis, the Stakeholder Theory is used as a descriptive tool to study existing organizations.

APPLICATIONS OF STAKEHOLDER THEORY IN BROADBAND DEVELOPMENT

In literature relating to the development of infrastructure and services in a country, stakeholders are not always analyzed (examples include (An-Shou, Fleischmann, Ping, & Ishita, 2010) (Choudrie & Dwivedi, 2004)). Mostly the terminology "stakeholder" is used to refer in passing to the actors in the Broadband ecosystem. In other cases the stakeholder discussion is often made in the following ways:

- Stakeholders are identified for the role played in the Broadband ecosystem in both on the demand and supply side of the Broadband Market (Choudrie & Dwivedi, 2004).

- Their existence in the Broadband ecosystem is acknowledged (Gómez-Barroso & Feijóo, 2010).

- They are acknowledged as constituents of institutional arrangements and partnerships (Falch & Henten, 2010) (Nucciarellia, Sadowski, & Achard, 2010) (Fredebeul-Krein & Knoben, 2010).

- Their roles, engagement and interests in the delivery of Broadband infrastructure as well as the acknowledgement stakeholder diversity (Fredebeul-Krein & Knoben, 2010) (Rowley, 2011).

This list is not exhaustive as there are various areas of discussion that involves stakeholders with respect to the development of Broadband which may not be exhausted in this report.

Aside the general outlook towards the concept of the stakeholder, there has been other instances where, although the stakeholder discussion was made in passing, other theoretical approaches were used to analyze stakeholder relations within the Broadband ecosystem. An example is the renaming stakeholders as agents. This has been used in analyzing the mode of facilitation of stakeholder activity to enable Broadband market development (Beltran & Mirza, 2014). The theoretical approach here was the Agent–Based Model to simulate a series of scenarios that portrays how the rate of Broadband uptake is affected by different factors.

Still, there have been efforts made to use the stakeholder theory in analyzing the relationships between existing stakeholders in either the Broadband ecosystem or its sub-set. These are mostly instrumental and descriptive stakeholder theoretical approaches as the authors were examining already existing stakeholder relationships in either the supply or demand side of the Broadband market. South Korea has been a country where some academics have adopted the stakeholder theory as an approach to understand how the development of Broadband evolved. Example for the supply side includes the relationship and activities of stakeholders towards the diffusion of Broadband in South Korea (See (Choudrie, Papazafeiropoulou, & Lee, 2003). An example for the demand side includes how contradictory stakeholder objectives could affect the slow adoption of the Norwegian Government to Government (G2G) e-government initiative in Norway (Flaks & Nordheim, 2006). The essence of this initiative was to facilitate the demand for Broadband.

One would say that in the near future as the relationships, there is every possibility that Stakeholder Theory will be used more in analyzing the role of stakeholders in the development of Broadband. At that time, probably, there would be some form of Broadband infrastructure saturation in some part of the world. This saturation situation would of course prompt research into the journey so far to understand the nature of stakeholder relationships and what were the resultant effects. Hence a normative form of stakeholder theory in this regard will emerge that would deal with the stakeholder ethics and values in the course of the developing Broadband infrastructure.

5.4.2 STAKEHOLDER MODEL –STAKEHOLDER THEORY OF IDENTIFICATION AND SALIENCE

Stakeholder salience explains the extent to which managers grant importance to competing stakeholder claims (Mitchell, Agle, & Wood, 1997). These levels of importance are based on the stakeholders attribute in relation to the manager. The attributes include, power, legitimacy and urgency claims.

Power: Mitchell, Agle & Wood (1997) explains the power to imply "which has power….to impose its will in a relationship".

Legitimacy: Their adaptation of the concept of legitimacy was quoted from legitimacy to from Suchman's (1995). Suchman defines legitimacy as "a generalized perception or assumption that the actions of an entity are desirable, proper or, appropriate within some socially constructed systems of norms, values, beliefs and definitions (Suchman, 1995) "

Urgency: Mitchell, Agle & Wood (1997) explains urgency as the extent to which stakeholder claims call for immediate attention.

The presence of one or more of these attributes explains the characteristic of the stakeholder. The stakeholder may be:

Dormant Stakeholder: They possess the unused power to impose their will, but have no legitimate or urgent claim on the manager.

Discretionary Stakeholder: They have legitimacy, but no urgent claims and have no power to influence the firm.

Demanding stakeholder: They have urgent claims, but do not having no power or legitimacy.

Dominant Stakeholder: they have both power and legitimacy, hence they have an influence on the firm.

Dangerous stakeholder: they possess urgency and power, but lack legitimacy, they get their way by coercion. An example, could be a labor union, as they are capable of going on strike to claim legitimacy.

Dependent stakeholder: they possess urgency and legitimacy, but lacks power. They depend on others to carry out their will.

Definitive stakeholder: The posses power, urgency and legitimacy. The stakeholder salience is high. Dominant stakeholders may become definitive when their claims become urgent.

Non-Stakeholder: They possess none of the attributes.

Mitchell, Agle & Wood (1997) have been quick to admit that all these attributes may not be found in a stakeholder, manager relationship but they matter. This is why such an agency would be a non-stakeholder. However, a stakeholder with all the three attributes is a definitive stakeholder or a stakeholder that cannot be ignored. This is not to imply that other stakeholders are invalid, rather they are stakeholders whose importance or salience may rise depending on their successful claim to a deficient attribute making them indispensable to the manager. In the same vein, the salience of the definitive stakeholder may also decrease if circumstances change. For example, the firm decides to pay more attention to another brand of products in which the stakeholder does not provide or there could be an external or internal regulation that makes the stakeholders claim to the firm non valid. This is why Mitchell, Agle & Wood (1997) explains that stakeholder saliency is dynamic and not static.

In the case where the stakeholder is deficient in one or two of the attributes, Mitchell, Agle & Wood (1997) groups them into 2 stakeholder groups respectively namely latent stakeholder and expectant stakeholder. The expectant stakeholder can either gain salience to become a definitive Stakeholder or lose salience to become a latent Stakeholder. However, they are Expectant because their importance to the firm is expected, all things being equal. It is also important to note that they could remain permanently expectant. However, they cannot be ignored by the manager. The latent Stakeholder can be ignored according to, Mitchell, Agle & Wood (1997), but not always, especially if they require urgency, even if they lack the legitimacy or the power to change things. However, they possess potential relationship possibilities to the manager.

Mitchell, Agle & Wood (1997), identified the latent and Expectant Stakeholders as follows:

The Latent Stakeholder: Dormant Stakeholder, Discretionary Stakeholder, Demanding stakeholder.

The Expectant Stakeholder: Dominant Stakeholder, Dangerous stakeholder, Dependent stakeholder

Hence the three important stakeholders are the latent, expectant and definitive stakeholders. These relationships of these stakeholders could be presented in a normative, descriptive or instrumental form. In this report, the descriptive approach is adopted.The relationship between the latent expectant and definitive Stakeholders is expressed in the figure 8.2 below.

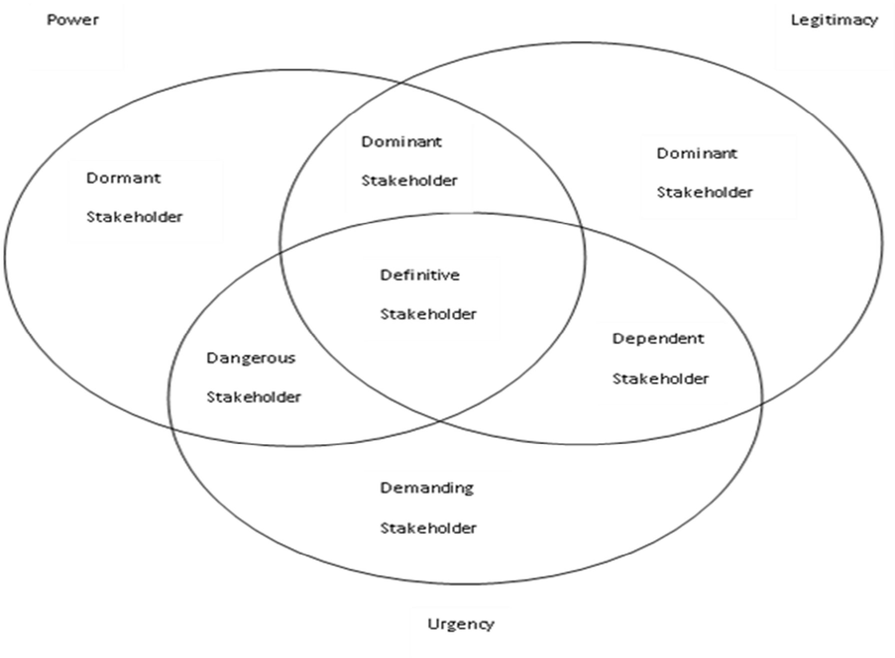

Figure 5- 3 Stakeholder Topology

Source (Mitchell, Agle, & Wood, 1997)

RATIONALE FOR ADOPTING STAKEHOLDER THEORY BY MITCHELL, AGLE & WOOD

This research is not concerned with an agency's dealing with internal stakeholders. The central agencies for this research are the universality funds of the secondary cases. They have to partner external agencies in order to fulfill their Universal Access and Service mandates. Hence this research is concerned with the external stakeholders' relationship with these central agencies. The reason for understanding the level of importance of each of the stakeholders is to understand, based on the existing projects, who the universality fund's value working with the most. This exercise provides a picture of the operating environment of the secondary cases, so as one could still understand what still needs to be there or what has to change if the residents in rural areas would be served with Broadband internet. These agencies by law, as it will be seen later in this report, are mandated to partner almost any other agency – be it public, private or civil society stakeholder- to fulfill its mandate.

However, in the proposition of community based networks, it is important to identify possible agencies that are very relevant to the scheme as identified from data gathered secondary stakeholders. However, it will be difficult to just suggest the actors identified from the secondary cases to the secondary cases without necessarily finding out, who are the most relevant stakeholders that exist already in the secondary cases. What is their level of importance to the Universality funds and how are they functioning currently in their current or past collaborations with the universality funds.

The adoption of the stakeholder salience aids in making this identification. With these identifications, one would classify the various stakeholders into Definitive stakeholders, the expectant stakeholders and the latent stakeholders. The definitive stakeholders would be those whom the universality funds cannot do without as they possess all the three attributes. The expectant stakeholders would be those which possess two of the three attributes. Consideration will only be made for the latent stakeholders in the final analysis if they would be useful for the community Broadband network.

Hence this theory aids this research to understand how the universality funds relate with these stakeholders. Do they treat the stakeholders as the theory predicts or is there a different approach to reality? For the research, the idea is to find out how important the stakeholders are to the universality funds and if the universality funds are flexible enough to grant salience to new stakeholders for the purpose of developing Broadband in rural areas. Understanding their flexibility is important because it provides an understanding on the institutional , organizational culture and norms towards accepting new ideas towards investing in Broadband in rural areas.

5.5 GROUNDED THEORY

Grounded Theory distills explanatory notions from data (Thomas, 1997) . Grounded Theory originated by sociologists Barney Glaser and Anselem Strauss in 1967 (Glaser & Strauss, 1967). Glaser and Strauss (1967) explain that Grounded theory involves generating theory from data and how the theory can be rigorously tested. The strategy of inquiry is inductive reasoning. The components of the Grounded Theory include systematically obtaining data, analyzing data and generating a theory or a hypothesis from the set of data analyses (Glaser & Strauss, 1967). Grounded Theory has been identified as a methodology (Strauss & Corbin, 1998), a method of comparative analysis (Glaser & Strauss, 1967), a rationale for qualitative analysis to develop a theory (Charmaz, 1983), and for content analysis (Cho & Lee, 2014). Despite these varied approaches to Grounded Theory, Glaser and Strauss (1967) explain that the Grounded Theory provides explanations, predictions, interpretations and how things apply to one another. Glaser further explained that Grounded Theory is not a means of verifying the theory.

Although Charmaz (1983) identified Grounded Theory with qualitative research, Glaser and Strauss (1967) argue that quantitative data can be used inductively to generate theory. The fundamentals of Grounded Theory are the micro- analytical approach to data collected. Here the researcher searches for conceptual themes. These themes are labeled or coded. The codes analyzed by reason of their dimensions and properties and grouped along these lines till there is a saturation (Charmaz, 1983) (Strauss & Corbin, 1998). It is at the point of saturation that relationships among the core categories is investigated and formed towards developing a theory (Strauss & Corbin, 1998). These differences have led to the emergence of the different traditions of Grounded Theory. These traditions share similar and different attributes. This section discusses these traditions and identifies the tradition used for this report.

5.5.1 SIMILARITIES IN GROUNDED THEORY TRADITIONS

Although these fundamentals exist, the approaches towards facilitating Grounded theory are similar in some ways and differ in other ways. The similarities are based on the fact that:

- The researcher should not be influenced by preconceived notions when collecting data and should collect data from a wide array of sources, hence open-ended.

- The coding process is a form of symbolic interactionism where the researcher interacts with the signs and symbols (semiotics) to derive negotiated meaning (Cho & Lee, 2014). Glaser and Strauss (1967) call it a comparative analysis as the researcher moves back and forth on data.

- Memo writing and diagrammatic representations are the conceptual building blocks towards the building of theory (Strauss & Corbin, 1998). Memos are elaborated ideas about the codes. Memos can be sorted in categories (Charmaz, 1983). It is at this stage that the relationship between categories are formed leading to emerging theory. It is at the level of the focus coding that the theoretical framework emerges.

- All the traditions adopt theoretical sampling as a way of inducing theory from data. Theoretical sampling involves joint theoretical collection, coding and analysis of data (Glaser & Strauss, 1967).

- The theoretical sampling approach requires that data gathering, coding, analysis and theory generation occur simultaneously.

- The properties and dimensions of the codes or concept play a role in the coding process (Strauss & Corbin, 1998). The properties determine which codes can be abstracted based on common meaning to form a hypothesis or theory. The dimensions provide a range between the similarities of the codes and the variance of the codes.

The differences on the other hand, are more about the analytic procedure than in how data are analyzed. This is evident in the table below. These analytical procedures represent some Grounded Theory traditions aimed at developing theory from data. There are many Grounded Theory traditions. However, in this report, the focus is on three traditions. The three traditions are chosen as they represent different approaches. Glazer and Strauss (1967) were specifically chosen because they are the founders of the theory.

5.5.2 DIFFERENCES IN GROUNDED THEORY TRADITIONS

The identified differences exist at the point of identifying concepts, grouping and relating the concepts and theory formation. In order to identify the differences, a brief overview of each tradition will be explained.

Table 5- 7 ***Some Grounded Theory Traditions***

		Charmaz Tradition	**Strauss and Corbin**	**Glaser and Strauss**
	Stages	Constructivist approach	Systematic approach	Emerging theory approach
1.	Identifying concepts	Initial Coding	Open Coding	Substantive coding
2.	Relating/Grouping categories	Focused coding	Axial Coding	
3.	Theory formation	Theoretical Coding	Selective coding	Theoretical coding

Sources ((Charmaz, 1983) (Strauss & Corbin, 1998) (Glaser & Strauss, 1967))

GLASER AND STRAUSS TRADITION

Grounded Theory in the Glaser and Strauss tradition is the use of theoretical sampling to develop either a substantive theory or a formal theory - hence an emerging theory approach. Substantive theories are theories used for empirical inquiry on a specific area, while a formal theory is the theory that can be used in a field of inquiry (Glaser & Strauss, 1967). The difference between both theories as explained by Glaser & Strauss (1967) is their variance with each other in the degree or dimensions of utilization.

The data analysis process of the Glaser and Strauss tradition is used to develop the substantive theory first. This is referred to as substantive coding. Once the substantive theory emerges, the theory can be used to analyze similar cases or areas of inquiry. In order to produce a formal theory (generalized) in the field, the same theoretical sampling procedure is used, but the aim is not to produce specific codes but generalized codes. This is because, as explained by Glaser and Strauss, the emerging theoretical variables should be relevant to the field of study. This coding process is identified as the theoretical coding, which can either be an abstraction of the substantive theory or an independent abstraction process from the same data or a combination of the same data with more data from the field. The abstraction in the case of a multi-area research can be enhanced by going though the data and bringing to bear, the researcher's knowledge and experience. This is the only point where preconceived notion is allowed in this tradition. In the case of a one area, formal theory, Glaser and Strauss mentions the possibility of rewarding the variables in the substantive codes, if possible (Glaser & Strauss, 1967). However, Glaser and Strauss did provide the room for a substantive theory to be regarded as a formal theory, if the substantive theory formed can be generalized (Glaser & Strauss, 1967).

The coding process in this tradition involves jotting categories and properties of the codes at the margin of the field notes. In the process, the researcher must keep an eye for emerging categories and reformulating them as their properties emerge. The researcher has to prune the list of categories, while adding to it until the core of the theory emerges, the researcher will then have to identify the categories that relate to the core in order to form a hypothesis and later integrate it into a theory.

CHARMAZ TRADITION

In Charmaz tradition, the coding exercise is to identify a process that is ongoing to social life, hence constructivist in nature (Charmaz, 1983). The variance between the general social construction of reality in Grounded Theory in general and the Charmaz tradition is:

- In the investigation of a process, the Charmaz explains that the social construction of reality for Grounded Theorist is aided by questions such as "*What kind of events is being investigated? How are these events constructed? And what do these evens signify?*"

- The twist added by Charmaz is the extension coding activity to include coding for implicit attributes of the social factors, such as the feelings, thought, values, viewpoints etc.

The Charmaz tradition begins with an assumption aimed at "*discovering, identifying and asking questions about these assumptions*" (Charmaz, 1983). This differs from the Glaser and Strauss tradition where one identifies an area of inquiry and decides to gather data to generate theory about it.

The data analysis process in this tradition differs from the Glazer and Strauss tradition. This is because; the theoretical sampling process for the substantive theoretical sampling is divided into two stages. The first stage is the searching for the concepts (codes) in the data and the second stage is the grouping of the concepts into categories as well as interlinks the categories to form a substantive theory. The code searching is referred to as initial coding and the second stage is the focus coding (Charmaz, 1983).

In the initial coding process, the researchers in this process, Charmaz explains, are in search for "*leads and ideas in the data themselves*". In the micro-analytical process, she recommends is line-by-line coding. She advises against the reliance on preconceived notions and to "*study the emerging data*" as a means of deriving meaning from the data at this stage (Charmaz, 1983). In the focus coding process the categorization could be developed from the natural language of the participants (in vivo coding) or the categorization could be based on themes from the researcher's analytical interest (Charmaz, 1983). The focus codes are delineated by their properties. Here, unlike the case of Glaser and Strauss (1967) where the use of preconceived knowledge is reluctantly permitted at the theoretical abstraction stage, the researcher's knowledge of literature can be used to expand the codes. The focus codes could be causations, process, degree or dimensions. It is at the focus coding stage that substantive theories are formed, once relevant categories are interlinked. The same theoretical process is used to develop a formal theory or just like the case of Glazer and Strauss (1967), the formal theory can be abstracted from the substantive theory.

STRAUSS AND CORBIN TRADITION

The process of data analysis on Strauss and Corbin (1998) is simplified and stratified. It provides a systematic approach to the doing Grounded Theory comparative analysis (going back and forth on data) process. This is why in this research it is called the systematic approach. A difference between Strauss and Corbin (1998) is the fact that there is a dichotomy between the coding for the process and the coding for dimension and properties. The reason for this dichotomy is because both analytical processes seem to answer different questions. Process for Strauss and Corbin implies a "*Sequence of evolving action/interaction, changes in which can be traced to changes in the structural conditions*" (Strauss & Corbin, 1998). This outlook to process is not different in other Grounded Theory traditions. However, what is different is the concept of interest in the event process. In the case of Strauss and Corbin, the concept of interest is action/interaction as the event unfolds. Hence, this is a way of retracing the dimensions and properties of a phenomenon to understand the present state of the phenomenon. The analytical process for both, coding for process as well as coding for properties and dimensions are the same. The difference is based on the fact that one is in search for Actions/interactions in a process and the other process is designed to search for properties and dimensions. The two approaches are not mutually exclusive. This is because categorization in the coding for the process is being aided by properties that spell action/interactions. On the other hand, categorization for properties and dimensions, depending on the area of interest could include action/reactions that results in some consequences.

In the analytical process, one would say that the Strauss and Corbin tradition provides a microscope into the theoretical sampling process. The process of identifying and coding the concepts is regarded as the open coding process. This is similar to what Charmaz identifies as initial coding. The process identified as Focus coding is broken into two processes by Straus and Corbin. The first process is the grouping of the codes along the lines of their properties and or dimensions. This process is carried out till there is saturation. The process could result in sub-categories under one category. This is called axial coding by Strauss and Corbin (Strauss & Corbin, 1998). It is at this point that the central phenomenon and the relating categories begin to emerge along the lines of their properties. Here is where the researcher is theoretically sensitive to what forms of relationship might be emerging. The causal conditions, the intervening conditions, actions/Interaction and consequences emerge during the Axial coding process. If it does not emerge, one returns to the data to study the data again or the field to gather more data. Here the researcher could return to the same data source or to a similar data source to gather data that can be compared with what the researcher has already. The second part of Charmaz's Focus coding, is regarded as Selective coding by Strauss and Corbin. Here the researcher begins to identify relational categories around the identified the central phenomena. In the case where there are not clear relationships, then abstraction comes into utilization as the researcher reflects on what the code means and relational statements or stories are weaved around the emerging set of relationships.

Strauss and Corbin in their outlook also differ from other traditions as they see the Grounded Theory process also as a deductive process (Strauss & Corbin, 1998). The deduction here is not from theory but from data. In the other traditions identified in this report, Grounded Theory is regarded solely as an inductive process. Another difference is the fact that Strauss and Corbin does not write off the influence of pre-conceived notions or theories. They agree that our existing knowledge of the phenomena influences how the codes are named. However, the advice is that the researcher minimizes the influence of pre-conceived knowledge. But they concede that these preconceived notions can be useful at the selective coding stage.

5.5.3 GROUNDED THEORY APPROACH USED IN THIS REPORT

The Grounded Theory tradition used in this report is that of Strauss and Corbin (1998). The Charmaz approach would have been used as it is also a process driven approach. However, the aim of the report was not aimed at actually identifying implicit factors that facilitated Broadband internet development in the primary case study. Although there were implicit factors, that were evident and could be documented. However, the focus of this report was not to unearth those factors. The second reason for not using the Charmers tradition was because how to adequately apply the focus coding process was not clear from my research questions. The Glazer and Strauss tradition was not used because the aim of the study of the primary case study was not to produce a formal theory. The aim was to understand a process. Hence, in order to understand the process, it had to be retraced. This is where the process coding of the Strauss and Corbin tradition became significant for the study of the primary case study. The Strauss and Corbin process provided a roadmap towards investigating the implementation process.

5.6 THEORETICAL TRIANGULATION

Theoretical triangulation is the process where more than one theoretical approach is used to interpret data (Denzin, 1970). In this report, theoretical triangulation was adopted as a means of providing qualitative validity to the data gathered for the second case study. The validity test was possible based on the fact that both theoretical approaches provided a means of retracing the origins of the cases in the primary case study.

This research is made up of two case study researches. The first case study research is the called the primary case study research in this report. The second case study research is called the secondary case study in this study. In the first case study – the primary case study, the Actor Network Theory and the Grounded Theory are used to interpret data. One would argue that the Grounded Theory is not a theory but a way of grounding a theory. That is correct. However, it is a means of interpreting and analyzing data as well as mentioned earlier in this section.

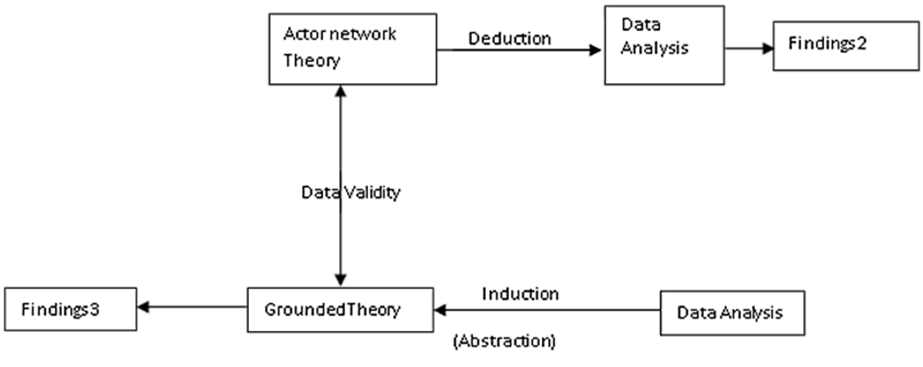

Figure 5. 1 Theoretical Triangulation for Primary Case Study

Deductive data interpretation was performed with the Actor Network Theory. Inductive data interpretation was performed using the Grounded Theory approach. Both approaches were used for different purposes as seen above. The respective findings (findings 1, findings 2 and findings 3) are responses to the research questions. Findings 1 provide answers to sub-research question 1. Findings 2 and 3 jointly provide findings to sub-research questions 2 to 6. The findings provide the inspiration for the answers to the overall research questions. In the secondary case study, the only theory adopted is the Stakeholder Theory. This is deductive in nature.

Figure 5. 2 Theoretical Approach for Secondary Case Study

The implication of the theoretical triangulation is the use of the multi-method (methodological triangulation) and data triangulation. These forms of triangulation were necessary for the research validity process. The theoretical triangulation was not necessary for the secondary case as the sample size of the data was insignificant. However the theoretical triangulation approach was adopted because the researcher wanted to construct reality in the secondary case study. Hence, if the reality constructed was to be qualitatively valid, then another theoretical approach was needed to facilitate the validity of the data collected and to build a coherent justification of the themes.

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END OF LITERATURE REVIEW SECTION

CHAPTER 6. RESEARCH METHODOLOGY

6.0 INTRODUCTION

This chapter explains how the research was carried out and how the research was designed. An academic research provides a logical and systematic way, aimed at finding scientific solutions and solutions to social problems (Rajasekar, Philominathan, & Chinnathambi, 2013). The purpose of this form of inquiry is to uncover the truth or search for truth about the phenomena. Based on this definition, this is an academic research. The logical and systematic approach (scientific) towards the development of the Public - Private Interplay models aimed at solving a social problem is described in this chapter.

In this chapter, how the research was designed and facilitated is explained. The explanation is done using the Saunders Onion methodological framework.

6.0.1 RESEARCH DESIGN

Research design is the overall plan for data collection in an empirical research project (Bhattacherjee, 2012). It provides a roadmap that aids in the navigation of the research process from the research question or posing of hypothesis till when the hypothesis is either confirmed or research questions answered. As mentioned earlier in this chapter, the Saunders Onion is adopted. The “onion” is a characterization of the research process from a more generalized outlook down to the more specific data collection techniques and analysis procedures adopted in the research process (Saunders, Lewis, & Thornhill, 2009). Saunders, Lewis & Thornhill (2009) calls the onion process “*a progressive logic*”. This onion description is synonymous with the research design. The research design outlines the research methodology and the research methods utilized in carrying out the research. Different researchers have different ideas on what should constitute the research design or onion process. Some of these ideas are represented in the table below. The rows begin with the outer onion to the inner onion.

Table 6- 1 ***Some Research Design Approaches***

Author	**Saunders, Lewis and Thornhill (2009)**	**Bhattacherjee (2012)**	**Kothari (2009)**	**Creswell (2009)**
1.	Research Strategies	The data collection process	Procedures and data techniques used to gather data	Philosophical assumptions
2.	Research choices	The instrument development process	Methods used for processing and analyzing information	Strategies of inquiry
3.	Time Horizons	Sampling process	The population to be studied,	Specific research methods
4.			A statement of research problem	
Discipline	Business	Social science	Interdisciplinary	Interdisciplinary

Williams (2015)

Although, the following concepts are not captured in the table above, Saunders, Lewis and Thornhill (2009) also identified research philosophy and approaches as implicit elements of research design, which drives the explicit element of research strategies', research choices and time horizons. However, what was explicitly stated is what is represented in the table above.

The component of the table above indicates that different ideas exist in different disciplines as to what constitutes a research design. The difference, one might say, is a matter of wording that explains each step of the research process. An example is Bhattacherjee's (2012) use of the phrase, "*The data collection process*". On the other hand, Kothari (2009) uses the phrase "*procedures and data techniques used to gather data".* The second difference is in how each author views the process. An example is Saunders, Lewis and Thornhill (2009) where the research methods and techniques are grouped under research choices. While on the other hand, Kothari (2009) separates the method of data analysis from the research method and techniques. Creswell (2009) views it as specific research methods.

Although these differences exist there are similarities as well. The major similarity is based on the fact that each author has the same line of thought. However, as mentioned in the case of Saunders, Lewis and Thornhill (2009), certain aspects of the research design are implicit and embedded in the researcher. This cuts across the other cases. However, they all imply the same thing, but are arranged differently by different academic scholars. However, research design in a nutshell, is summarized by Creswell (2009) to, imply the implicit philosophical assumptions, the explicit strategy of inquiry and the specific research methods.

6.0.2 RESEARCH METHODOLOGY

The research design can also be called the research methodology. Based on the above explanation, one could say that research design outlines the "*how*" of the research. The "*how*" is synonymous to the methodology. However, the research design mentioned above was a noun. This implies that it was just the name of a process with certain components. But, when the actual design process occurs, the research design becomes a verb, this is what is synonymous to the methodology. A research methodology or the methodological framework of a research is defined in different ways as seen in the table below.

Table 6- 2 Some Disciplinary Definitions of Research Methodology

	Definition	**Discipline**	**Author**
1	The adoption of principles, theories and rules that guide a particular approach to research as well as the collection of methods is identified as a methodology	Social science	(Somekh & Lewin , 2005)
2	The research methodology identifies a systematic way in which a research problem was solved	Natural sciences	(Rajasekar, Philominathan, & Chinnathambi, 2013) (Young & Schmid , 1966) (Gooddard & Melville, 2004)

Williams (2015)

These definitions are not necessarily representative of the fields of study under the natural and social sciences; rather they are examples of useful definitions that could be used to understand what constitutes a methodology from both points of view. However the definition adopted in this report was from the social science point of view. The natural science definition is also important because the research design provides that systematic way to solving the research question of this report. This example, provides some argument to the fact that the research design is the research methodology. This is the reason this chapter is named the research methodology.

This implies that the components or selected components, depending on the field or discipline of the research, are being utilized to facilitate the purpose of the research.

Before proceeding, it is important to note that methodologies abound in every sphere of life. Consultants adopt different approaches to solve problems; politicians also adopt some form of approach to solving problems. The methodologies used in these cases may or may not be standardized or systematic. However, in the case of an academic research methodology, a systematic approach to solving the problem is a must.

6.0.3 ADOPTED RESEARCH DESIGN

In the previous sections, it was clear that there is no consensus about the standard form of research design. In some of the literature, the research methodology process is written to suit a particular research strategy. An example is the popular work of Yin (2009) on case-studies research, Greenwood & Levin (2006) on Action Research etc. (See (Yin, 2009) (Greenwood & Levin, 2006)). In the methodologies studied for this report, the case was not different with regards the research disciplines by which the author's audience varied (See examples (Young & Schmid , 1966) (Bhattacherjee, 2012) (Yin, 2009) (Mackenzie & Knipe, 2006). An example is represented in table 6.2 above. As a result of this variance in reading through the various literatures, there were two major challenges encountered. It was evident that there was this interesting way the use of the word "*research strategy*", "*research approach*" and the determination of "*data types*" by different scholars. A few example are listed below.

- Research strategy: For Saunders, Lewis and Thornhill (2006) from the business research point of view implied if a research was a case study, Ethnography, Action Research, Grounded Theory, etc.. For Creswell (2009), inquiry strategies implied that it was either a qualitative, quantitative or mixed method research. Kothari (2009) identifies the research strategy as the methodology itself, which implies paradigms, methods, etc.

- Research approach: For Kothari (2009), the research approaches as either quantitative or qualitative approach. Here he sub-classifies the quantitative approach into inferential, experimental and instrumental approaches. Kothari's (2009) view is supported by Bhattacherjee (2012) and by Young & Schmid (1966). Mackenzie & Knipe (2006) identified research approach as case study, descriptive feminist, Action research etc., from the educational research point of view. For Saunders, Lewis and Thornhill (2006) from the business research point of view implied if a research was a deductive or inductive research.

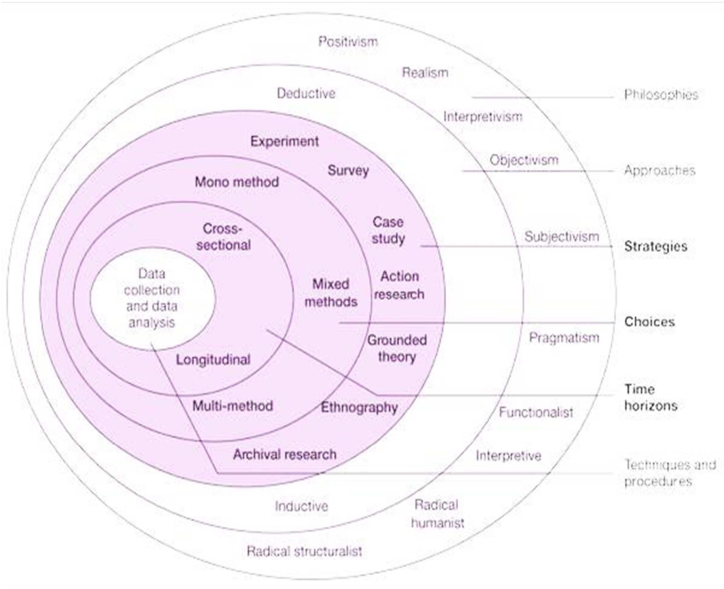
- Determination of data type: This was identified in Mackenzie & Knipe (2006). Their research was a social science research, but on educational issues. Here they determine data types as either qualitative or quantitative data types.

Research methodologies are stated either in explicit or implicit formats. In the natural sciences, the research paradigm is implicit and the focus is rather on the methods of inquiry. However, in some of the social science disciplines (such as sociology and economics) and in the humanities, the research paradigms and methods are explicitly stated. The level of explicit description of the methodology differs from researcher to researcher, from field to field and from discipline to discipline.

Based on these challenges, the research design, facilitating the research methodology had to be chosen from one of the frameworks identified in the book. Though these frameworks had minor variances and formats - especially in the non-natural science frameworks – Saunders, Lewis and Thornhill (2009) condensed their framework into what they called the Saunders "*Onion*".

This framework was clear and the components of the other frameworks could be identified in the Saunders "*Onion*". Hence the Saunders "*Onion*" became the overarching methodological framework for this design. The other frameworks played a supporting role and the processes in other frameworks had to be identified with the names given to it in the Saunders Onion.

The figure below represents the Saunders Onion.



Source (Saunders, Lewis, & Thornhill, 2009)

In the Saunders Onion, the first three processes are implicit –as they are universally- and the last three processes are the actions and hence explicit. The implicit causal factors to the researchers' actions are the philosophies, guiding the researcher, the approaches adopted by the researcher and the research strategies adopted by the researcher. The explicit actions are the choice of methods, the time horizons and the data collection techniques and analysis. In the next section of this chapter, an explanation of how the various processes occurred in this report will be presented.

6.1 RESEARCH PHILOSOPHY

The research philosophy also known as research paradigms are implicit and they are our underlying philosophical guides, belief systems or mental models or frames of reference that are used to organize out reasoning and observations (Bhattacherjee, 2012). In other cases it is referred to as world views (See (Creswell , 2009)). Philosophical intent, epistemology and ontology are other ways by which the research philosophy is referred to (Mackenzie & Knipe, 2006). There has been an assertion that the research process is not possible without paradigms or the research philosophy (Mackenzie & Knipe, 2006). This is because from Mackenzie and Knipe's (2006) view, the choice of methodology, literature and research design will not be possible. Examples of paradigms include positivist/postpositivist, interpretivist, transformative, pragmativist, participatory/advocacy, emancipatory, deconstructivist and many others (Mackenzie & Knipe, 2006) (Creswell , 2009).

However, the research philosophy of this report is interpretivist (anti-positivism) as well as the constructivist paradigm.

6.1.1 INTERPRETIVIST PARADIGM

Interpretivism is concerned with interpreting and observation as a means of deriving meaning of the social world (Ormston, Spencer, Barnard, & Snape, 2013). Interpretivism is a more subjective form of understanding or studying a phenomenon. The degree of objectivity is less in interpretivism. This is because the examined phenomenon is not studied independent of the humans, who are social actors as in the case of positivism (Saunders, Lewis, & Thornhill, 2009). The objectivity is accounted for by the pattern of logical thinking. The objectivity provides a non-universal systematic way examining the social phenomena. The lack of or low level of objectivity in Interpretivism, makes this philosophical paradigm "interpretive" in nature (Hay, 2011). Hay (2011) explains that the interpretations derived from the phenomena studied provide a guide the behavior and conduct of actors in the social system.

6.1.2 CONSTRUCTIVIST PARADIGM

The constructivist philosophical paradigm is often used to denote the social constructionism and social contructivism paradigms (Young & Collin, 2004). The constructivist paradigm is an extension of interpretivism. It is not uncommon to see both philosophical world views combined together (See (Mackenzie & Knipe, 2006)).

The constructivist world view holds that humans seek subjective meanings of their experiences and towards objects and things as a way of understanding the world they live and work in (Creswell , 2009). The argument for the constructivist paradigm in general is that reality is socially constructed (Berger, 1966). What separates the social constructivist and the social constructionist is that:

- Social constructionism is the purposeful production of knowledge via artifacts created by social interaction in groups. The interest of the group is on the artifact or social reality created.

- Social contructivism is the internal processes (derivation of personal meaning) of knowledge creation enabled by historical and cultural constructs through social process and action which enables the individuals to interpret their world. The focus of the group or individual is on the learning process

Source (Young & Collin, 2004)

6.1.3 RELATIONSHIP BETWEEN INTERPRETIVIST AND CONSTRUCTUVIST PARADIGM

In this report, the interpretivist and constructivist paradigms can be identified separately. However, in the overall scheme of things, both paradigms are used together as a whole. Their separate identities are inconsequential. This is because the construction of social reality is not possible without identifying humans as social actors as well as how humans make meaning of the environment they live in. However, upon reflecting on the work done in this report, it was plausible that one would see the individual identities of both paradigms. The plausibility factor is mentioned, because it is also possible that the reader may not distinguish the separate identities of both paradigms.

CONSTRUCTIVIST

The constructivist paradigm is the approach utilized in studying the primary cases. The constructivist point of departure of this report is social constructivism. In this report, an individual is on a quest to derive personal meaning about a social phenomenon – Broadband Internet infrastructure facilitated via a bottom up approach. Here the researcher's aim is to learn about the process. Hence the researchers' aim of working with the social groups is to understand how social order – in this case social relations aimed at facilitating Broadband networks in rural areas - is created. The term social is used because the report focuses on social issues.

In the primary cases, the researcher identified bottom up PPI/PPP approaches in other parts of the world as a means of supplementing what was lacking in the secondary cases. Hence the researcher was armed with the historical and social contexts of the secondary cases to search for the primary - cases. The social context was that the primary case had to be:

- A rural area or at most a semi-rural area.
- It should be a mixture of rural areas from developed and a developing country perspective.
- The socioeconomic conditions of each rural area had to vary with regards, education, personal income, geography and population, economy.

- People led initiatives

The historical focus was the circumstances that led to the infrastructure facilitation. These circumstances include the commonality in their personal, collective and social influences that led to the people organizing and facilitating the infrastructure.

In the secondary cases, the researcher studied the PPI approaches adopted within two Universal Access social systems. The idea here was to create meaning of how PPIs/PPP did facilitate the development of Broadband infrastructure as well as understand if they would adopt bottom up approaches. The ultimate goal of the inquiry was to learn about an existing process with the goal of having a basis to impose an external reality on the existing social ecosystem. Hence on one hand the researcher could understand the world of both cases as it were, as well as understand if there was room for change.

The meanings derived from the experiences of the primary and secondary case, led to the proposal of the PPI/PPP models proposed in this report. The meanings derived from the primary cases provided possibilities that would improve the existing reality of the secondary cases and similar other cases to the secondary - cases.

In this manner, reality is socially constructed from both the primary and secondary cases in order to simulate a social reality.

INTERPRETIVIST

In the secondary case, the focus is not necessarily on interpreting human actions, but the interpretation of a social system where institutions interact. The researcher uses the Stakeholder Theory to interpret stakeholder relations in the secondary - cases and the Actor Network Theory to interpret stakeholder or actor relations in the primary - cases. The Grounded Theory (an analytical tool) is used to interpret the implementation process in the primary - cases as well. These theories and analytical tools do not possess universal frameworks and they do not separate the social actors from the social entities. Hence, they are highly subjective and hermeneutical. However, the theories guide the interpretation by providing a reasoning pattern as one navigates the ocean of gathering and interpreting empirical data.

However, as mentioned earlier, both paradigms were used hand in hand in the investigations conducted in for this report. Based on the differences explained earlier, one would say that the difference between interpretivism and constructivism is blurry and negligible. The only clear distinction is that they differ in scope, but their attributes are the same. The role of interpretation in constructivism is to interpret the phenomena, so as to develop meaning.

6.1.4 PROPERTIES OF THE INTERPRETIVIST /CONSTRUCTIVIST PARADIGM

The characteristics of the interpretivist/constructivist paradigms as identified by Creswell (2009) are as follows:

- Constructivist/ interpretivist seek understanding or meaning about their world.
- They seek meanings from various sources; hence they adopt mostly qualitative methods and in some cases mixed method of gathering data (Mackenzie & Knipe, 2006).
- They rely on social and historical constructions in order to understand "what" and "how" the social system was created and for what purpose.
- They generate theory from the data gathered, which implies that the process is mostly inductive. This does not mean that it cannot be deductive or abductive.

Elements of these characteristics can be seen in the report. The explanation of meanings being investigated in this report was explained in sections 6.1.1 and 6.1.2 on the interpretivist and constructivist paradigms. The explanation of the social and historical construction was also explained in the previous section. The quest for meaning led to the identification of 6 primary cases, 2 secondary cases, article publication in journals to provoke discussion, conference participation to get secondary views, participation on Linkedin discussion on the issue, personal email correspondence, informal telephone interviews and teaching a related course in the university. These avenues served as a conduit pipe for extracting meanings sought for in the research questions. However, this report has not generated theories, but hypothetical models derived both from an induction and deduction processes. These processes were independent of each other.

6.1.5 INTERPRETIVISM/CONSTRUCTIVISM AND PHILOSOPHICAL ASSUMPTIONS

The choice of philosophical paradigms is driven by the researcher's implicit philosophical assumptions. Philosophical assumptions are the beliefs, values and ethics. These philosophical assumptions determine the thinking process of the researcher and how the researcher views the world in the process of the research (Saunders, Lewis, & Thornhill, 2009). The philosophical assumptions relevant to this report were the knowledge related assumptions and the value related assumption. The knowledge related assumptions are the epistemology and the ontology. The value related philosophical assumptions are the Axiology. The ontological assumptions are centered on the nature of reality and what there is to know about the world (Ormston, Spencer, Barnard, & Snape, 2013). The epistemological assumption is concerned with how knowledge is formed (Ormston, Spencer, Barnard, & Snape, 2013) (Saunders, Lewis, & Thornhill, 2009). Ormston et al (2013) further explains that epistemology in a broader sense is concerned with "*ways of knowing and learning and deriving meaning about the world*". Hence ontology is focused on the "*what*" factor of reality while epistemology is focused on the "*how*" factor in understanding reality. In a research process, being able to reflect on how the research was conducted and what could be learnt from the process is important. This branch of philosophy that explains the role the researcher played in making research choices is called axiology (Saunders, Lewis, & Thornhill, 2009).

EPISTEMOLOGY

In order to determine the epistemology for this research, it was important to study about epistemologies in the Science and Technology Studies, where this research is situated. The halt in this direction came after reading Alvin Goldmans critic of the use of social epistemology in STS. He actually disputed the fact that social epistemology under STS is a "real epistemology", rather he promoted social epistemology as a branch of traditional epistemology (Goldman A. I., 2010). His problem with the STS was they reject the core tenets of epistemology by trying to introduce new concepts to replace traditional epistemology. He termed them (STS practitioners) as revisionists as they replace rationality with little attention to the epistemic implications. This implied that the STS tilt would lead the research away from the standard social science academic research design. Hence, to salvage this challenge, as this research is an STS research, the Goldman's approach to social epistemology was adopted.

Goldman (2010) defines social epistemology as the "*study of the epistemic properties of individuals that arise from their relations to others, as well as epistemic properties of Groups and social Systems*" (Goldman A. I., 2010). Social epistemology has been divided into three categories by Alvin Goldman. These are:

- **Individual doxastic agent social epistemology**: This epistemology is pertains to "*individual belief-forming agents*" and how these agents ought to respond to "social sources of evidence" (Goldman & Whitcomb, 2011).

- **Collective doxastic agent social epistemology:** This Epistemology pertains to "*collective belief-forming agents*" and how these agents form their beliefs (Goldman & Whitcomb, 2011). Examples of collective agents cited by Goldman and Whitcomb (2011) are committees and juries.

- **Systems Oriented Social Epistemology:** This epistemology pertains to systems and how these systems influence the beliefs of their members (Goldman & Whitcomb, 2011). The authors cited, the legal system and the peer review system in the academia as examples of the systems they were referring to.

Goldman & Whitcomb (2011) did indicate that epistemologies differ from system to system and hence the concept of epistemology is contextual. An example could be that a research paradigm could be an epistemology in one research area and ontology in another research area. An example is Hay's (2013) work on interpreting interpretivism. He argued that Interpretivism had a stronger ontological perspective than epistemology. He does not out rightly deny interpretivism being an epistemology, rather he argues that it is less distinguished as an epistemology (Hay, 2011). From the ontological point of view, he identifies interpretivism as the quest to broaden the world view using hermeneutics. In as much as his argument holds for public administration research endeavors, it does not hold across the social science research spectrum.

However, this research is situated in the first category of Alvin Goldman's categorization. This was because the researcher was an individual. The individual had a framework for knowledge whose philosophical world view influenced how the researcher responded to sources of evidence. In this research, understanding of social environments of the primary and secondary cases was sought. The world view of the researcher in this report was the interpretivist paradigm. The interpretivist paradigm was chosen because it was a social research and the aim was to derive meaning from existing social constructions in the primary and secondary cases within the context of PPIs and Universal service. If the derivation of meaning of the existing social phenomena studied was all that was to the research, then the interpretivist paradigm would also have had an ontological significance in the research. This is because the nature of knowledge or world created via the analysis would have been the meaning or understanding of what is happening in the primary and secondary cases.

ONTOLOGY

Ormston et al (2012) did allude to the fact that realism and idealism are over-arching ontologies in the social science domain. They are partially correct as both idealism and realism are nature of knowledge truth or reality. Realism is the branch of philosophy that asserts that reality exists independent of our beliefs and understanding (Ormston, Spencer, Barnard, & Snape, 2013). Idealism is the branch of philosophy that asserts that no reality exists independent of our beliefs and understanding (Ormston, Spencer, Barnard, & Snape, 2013). Hence, from the ontological point of view, idealism reality is mind-dependent. Reality is what the mind knows it is and what the mind interprets it is. Realism on the other hand, reality is not mind-dependent, but mind-independent. For example, there is a generally accepted norm that a building is a house. The beliefs and values of the individual are not brought to task to analyze what the building should be called. However, where they are partially wrong is because realism and idealism also possess epistemological properties. Idealism explains how the beliefs and values of people shape their environment. Realism on the other hand explains how externally established norms shape our view of the world. Having identified the epistemological side of the identified epistemologies for the perceived social science ontologies, it is safe to say that the ontology just like epistemologies is relative to the research, field and context.

Main Ontology: The main ontological assumption was the social constructivism. The nature of knowledge the research question was aimed at producing was a relationship or set of relationships between the public and the private sector to facilitate Broadband Internet infrastructure. Hence the organizational and financial arrangements were of importance. The result of the nature of knowledge produced here would be the culmination derived from the existing social constructions to construct knowledge for academic purposes. As mentioned under the supporting ontological assumptions, these supporting ontologies served as building blocks for the process.

The construction of knowledge in this report was not the work of a super human, it was a cooperative venture between the researcher and the various social actors encountered in the process. From the Idealism standpoint, the beliefs and understanding of the researchers were greatly influenced from the beliefs and understanding of a lot of external social actors as mentioned in section 6.1.4. These external beliefs did not knock of the existing belief buttressed in the hypothesis; rather it reshaped the epistemology of how such a process can be facilitated. These influences from the social actors in this research influenced the facilitation of the Grounded Theory process. This was because truth was based on what the case actors did do, since they were successful at it. Truth from other sources had to be verified from literature or by asking an expert in the field. From the subjectivism stand point, the interpretation of how the social actors acted and its consequence to the social environment was mostly the researcher's attempt at social constructivism. Here the existing knowledge based on theory, stakeholder theory and Actor Network Theory influenced data collection and interpretation. Also simultaneously, as Grounded Theory was to be used as well. Hence, one would say that this endeavor was an interaction between the researcher and the society leading to the construction of knowledge. Here one would say that the researcher did the actual knowledge construction.

Supporting Ontology: Subjectivism and idealism were supporting ontological assumptions for this research. This was because idealism provides the opportunity to create reality from the researcher's socially constructed meanings from the cases.

Subjectivism on the other hand, provides a perception of the cases studied from the perception and consequent actions of the social actors (Saunders, Lewis, & Thornhill, 2009). Idealism was a constant feature in this research, but it was used in retrospective terms to ponder on questions responded to and data received. As the researcher listened to the interviews, read documents from the social actors researched, studied their websites, exchange emails, made telephone and Skype calls, the researcher's beliefs and understanding of telecom network facilitation played a huge role in questions that came later. In the case where new information was gathered from another social actor in another case, the reflections of the answers in the first case developed new believes, that led the researcher to extend those questions to the new case. In some cases, it was something they did not consider and the question would be, why did you not do it this way? An example is the case of Airjaldi, which was later commercialized, it was important to know why they did not form a cooperative? This question came up because in earlier interviews the primary cases, the social actors formed co-ops to help them facilitate the infrastructure. This process was important for the grounded theory as out of theory questions were asked in each of the cases to understand the process of implementation. Subjectivism was also a constant feature in the research because in order to propose a PPP/PPI model, it was important to understand from the primary cases how they got to the point that led them to facilitate the infrastructure development. What were their beliefs and values? How these did believes and values lead to causal factors that led to social action by the actors? In both case studies, the role of subjectivism was to understand how they (universality Funds) perceive PPIs, what are the current actions they are engaged in with regards PPI and do they think there is room for a bottom-up initiative? Hence, from the perceptions gathered in the primary and secondary cases, a PPI/PPP model could be proposed. Both Subjectivism and Idealism gave room for multiple participant meanings, social and historical construction and was not void of hermeneutics. The subjectivism used on the primary cases did aid in constructing the models from the Grounded Theory tools.

However, they were supporting ontological assumptions because they did not answer the research questions. That is to say that the knowledge outcomes from these ontological assumptions did provide meaning, but not the big meaning the research needed. This implies that the intended nature of knowledge aimed at based on the research question was not produced. Thirdly, components of these supporting ontological assumptions were found in the main ontological assumption. Hence the supporting ontological assumptions were a means to an end.

AXIOLOGY

So far in this chapter there has been mention of value in the process of social inquiry.

Topic: The reason for adopting this research topic was not to advance the agenda of certain special interest groups. Rather, this was an academic exercise in a subject matter that the researcher knows to be relevant and interesting. This is because the researcher developed an interest in telecommunication governance after the researcher completed his Master degree. The second reason for the interest is because the lack of ICTs in rural areas in some rural areas around the world – especially in rural sub-Saharan Africa - robs the citizens of those areas access to basic ICTs. The third reason for choosing the topic was because it was my way of contributing to solving a practical problem. Hence, from these stand points the topic was interesting. However, there exists a technology bias towards communication facilities.

Philosophical approach: The researcher's background is from the natural sciences-physics. Hence the researcher is from a positivist or more appropriately a post-positivist background. Post positivism is mentioned because the researcher had to test physical hypothesis. This is a background where objectivity is high as reality is not affected by the research process. There was no room for questioning why the titration of an acid and a base in a chemistry laboratory will not produce a purple color as facts and values are separate. In the post-positivist arena, the scientific world and the natural world are separate.

Crossing over to the social science field, the quest to find the actual meaning and give room to varied meanings of the world surrounding us led to the need to try another philosophical paradigm. Interpretivism from the epistemological standpoint provided that opportunity to adopt hermeneutical theories such as the Stakeholder Theory and the Actor Network theory to study the social ecosystems in this report. However, it must be stated that logic and rationality, as a result of my post-positivist background, could not be done away with. This was why the triangulation effort was made to combine the Actor Network Theory, The Stakeholder Theory and the Grounded Theory for data gathering and analysis. The Stakeholder Theory and Actor Network Theory had some form of loose deductive logic but lacked strong rationality. Hence the adoption of the Grounded Theory early in the research process provided a rigorous induction process.

In the post-positivist world, the nature of knowledge is predetermined to be positivist in nature. That cannot be changed. However, in the social sciences, the ontological outcome can be determined by the hypothesis. However the exact nature of the results is not deterministic in nature. This is where accuracy and precision is called to question in this field until the outcomes are tested and accepted as truth. Hence, in this research, the models developed are not tested; they will be tested in subsequent research. However, as it will be discussed later in this chapter, there is the validity of the data.

Data collection: More on this is discussed under the ethical considerations in this chapter. However, in this chapter, the researcher will point out that the use of idealism and subjectivism comes with an element of bias in the collection of data. The bias here had nothing to do with skewing the data towards a particular thought to serve a professional or personal purpose. The bias here occurred in the sense that data analysis was skewed towards the identification of PPIs, the search for implementation process in the secondary - cases and to understand the causal factors that led to the development of Broadband infrastructure in the secondary cases. This does not imply that there was no data overflow. Yes, there was, and this was important as a means of understanding the thought process of the social actors in the secondary cases.

6.1.6 IMPLICATION OF RESEARCH PHILOSOPHY ON THE TYOE OF RESEARCH

Qualitative research has been linked to constructivist and advocacy/participatory philosophical theories or paradigms (Creswell , 2009). This form of research has also been associated with the Interpretivism, post-modernism and deconstructism paradigms as well (Ormston, Spencer, Barnard, & Snape, 2013). However, one would imply that ontological researches bordering around Idealism and subjectivism as well could also be facilitated qualitatively as the researcher derives meaning of the world and derives experience of the world respectively via mental constructions and activities respectively.

Quantitative research has been linked to the positivist/post-positivist paradigm predominantly (Creswell , 2009). The ontology of quantitative research has been realism and objectivism as reality is independent of perception and consciousness respectively. This ontological stands did not provide the flexibility of thought needed in facilitating this research. Hence, from the philosophical assumption point of view of the research paradigms, this research is a qualitative research.

It is not true that all interpretive/constructivist research is qualitative. This is because in an interpretive research with a large sample size, qualitative data such as interviews may be analyzed quantitatively before meaning could be derived from a phenomena. This implies that the interpretations and the eventual social construction could occur via mixed-methods. Interpretive research could also be conducted qualitatively using multi-method data gathering techniques. Based on this reason, the research approaches, strategies, methods and techniques were designed to support the qualitative nature of the research.

However, it is important to note that if the intent of the mixed method research was not to just provide interpretations or construct knowledge; rather the purpose was to solve a practical problem, then this research would have been situated within the pragmatist school of thought.

6.2 RESEARCH APPROACH (LOGIC)

The choice of the research approach is important because it is the roadmap to answering the research question (Blaikie, 2007). The choice of research approach or more appropriately strategies is often influenced by the epistemological position (Ormston, Spencer, Barnard, & Snape, 2013). The research, logic for qualitative research can either be inductive, deductive abductive or retroductive (Blaikie, 2007). The qualitative research approach differs from the quantitative research approach which is in most cases deductive in nature. The summary of the approach is seen in the table below.

Table 6- 3 The logic of the Four Research Strategies

	Inductive	**Deductive**	**Retroductive**	**Abductive**
Aim	Establish generalizations used as explanation patterns	To test theories, in order to eliminate false ones and corroborate the survivor	To discover underlying mechanisms to explain observed regularities	To describe and Understand social lie in terms of social actor's motives and understanding
Start	Accumulate observation or data	Identify a regularity to be explained	Document and model a regularity	Discover everyday lay concepts, meanings and motives
Finish	Produce generalizations	Construct a theory and deduce hypothesis	Construct a hypothetical model of a mechanism	Produce a technical account from lay accounts
	Use the “”laws as patterns to explain further observations	Test the hypothesis by matching them with data	Find the real mechanism by observation and /or experiment	Develop a theory and test it iteratively

Source (Blaikie, 2007)

In the next subsection, a brief explanation is provided for these strategies or approaches as Saunders, Lewis and Thornhill (2009) would call it.

6.2.1 OVERVIEW OF THE RESEARCH APPROACH

Deduction: The deduction process begins with an existing theory or hypothetical relationships. These theories are applied to observations to either confirm or reject the theory or hypothesis (Ormston, Spencer, Barnard, & Snape, 2013). Deductive reasoning is also used in theory driven research that are not positivist in nature (Meyer & Lunnay, 2013). Deductive reasoning is the direct opposite of Inductive reasoning.

Induction: Induction begins data accumulation on an issue or research question propositions by which the researcher intends to investigate. The process ends with a hypothesis or generalizations and even theory formation extracted from the data to produce knowledge (Blaikie, 2007). This is a form of theory building (Saunders, Lewis, & Thornhill, 2009).

Abduction: This is a means of providing explanations for phenomena, a hypothesis or an existing theory concepts, etc.. The aim of abduction is to discover how social actors:

- Construct reality
- Conceptualize or see their social world
- Give meaning to their social world

Source (Blaikie, 2007)

As Blaikie (2007) explained, the aim is to understand "what" is going on and "why" it is going on. The resulting explanation does not necessarily prove or disprove the hypothesis, theory, concept or the existence of the phenomena, but also provides alternative explanations for their existence (Meyer & Lunnay, 2013). The difference between deduction and abduction is the level of certainty of the outcomes (Ormston, Spencer, Barnard, & Snape, 2013). In the case of deduction, the theory or hypothesis is either proven or otherwise. In the case of abduction, in circumstances where the theory is not proven, the empirical outcomes are tested to provide meaning (Meyer & Lunnay, 2013). As Meyer & Lunnay (2013) explains, the empirical testing could lead to iterations till a satisfied outcome is achieved. However, in an abductive process as the researcher is not bound by the confines of a single theory, deductive reasoning and inductive reasoning could be used in a complementary manner. The reason for this possibility is the fact that abductive findings in a theory driven research are not hindered by the confines of the theory. The researcher has the leeway to think outside the box.

Retroduction: As Blaikie (2007) explains, it is a "process of working back from data to an explanation, by the use of imagination and analogy" (Blaikie, 2007). The reason for working back from data is to provide conceptualizations that require that the researcher identifies circumstances without which the concept cannot exist (Meyer & Lunnay, 2013). Blaikie (2007) identifies the conceptualization as an observed regularity such as a theory, a phenomena, a concept, etc.. He explains that the researcher then needs to develop a conceptual or hypothetical model that holds plausible explanation of the existing concept. This hypothetical model provides a roadmap for the data needed to explain the identified concept. The researcher then proceeds to either observe or conduct experiments using the conceptual model. The reason for retroduction is to understand why the theory, phenomenon or concept exists (Blaikie, 2007).

Retroduction and abduction are similar logical strategies. Charles Sanders Pierce, the originator of the logical terms "abduction" and "retroduction" was believed to use the term interchangeably originally before separating it later (Chiasson, 2001).

The few similarities- at a glance –is based on the fact that:

- Both strategies begin with some form of inference (Blaikie, 2007).
- Both strategies are used to distinguish between the "actual truth" or existing truth and the "real truth" (Meyer & Lunnay, 2013).
- Their ontology is critical realism (understanding reality) (Meyer & Lunnay, 2013).
- Both strategies answer the "why" question
- Both strategies are complementary to the deductive process as the deductive process follows a specific research premise, while the abductive and retroductive processes lead data analysis beyond the original research premise to provide a link between the ideas (inferences) and the actual experience (Meyer & Lunnay, 2013).

However, both strategies differ as well. A few of these differences are mentioned in the table below.

Table 6- 4 Difference between Abduction and Deduction

	Abduction	**Retroduction**
1	It is a means of re-interpreting an existing phenomena or data to explain the existence of the phenomena	It is the means of conceptualization in order to understand the circumstances by which a phenomena cannot exist
2	Abductive inferences are existing concepts, phenomena, meanings and motives	Retroductive inferences or assumptions conceptualized by the researcher
3	Abductive researches are not theoretically driven. Theories may only be used as tools or aids, if necessary, to explain the process	Retroductive research begins with theoretical frameworks

Source (Meyer & Lunnay, 2013)

Both strategies can also be used in a complementary manner. In research abduction leads to the development of conceptual frameworks and this framework can be utilized via retroduction to develop a theory at the end of the day.

6.2.2 APPLICATION OF THE RESEARCH APPROACHES

The research approach in this report is a combination of the inductive and deductive research approaches or strategies. These strategies served independent purposes in the overall research strategy. The cases in the report were grouped into primary and secondary case studies. The case delineation was originally along nationality. However, the emergence of a breakthrough with regards to making contact with the Ghana Wireless Project led to the co-ops, social enterprises, municipality initiative and the NGO were identified as cases. Hence the primary- cases were a mixture of NGO led initiatives, Broadband cooperatives, a social enterprise that metamorphosed from a local NGO and a Municipality - led Broadband infrastructure delivery initiative. The secondary cases became institutions, the universality funds in Ghana and Nigeria.

Based on the segmentation of the cases, the research was divided into three sections. The results, culminating from these three sections would cumulatively lead to answering the research question. As mentioned in the theoretical approach chapter, a theoretical triangulation process was used as seen below. A, B, C represents the theories and analytical tool. A represents secondary case study while B and C represent the primary case study.

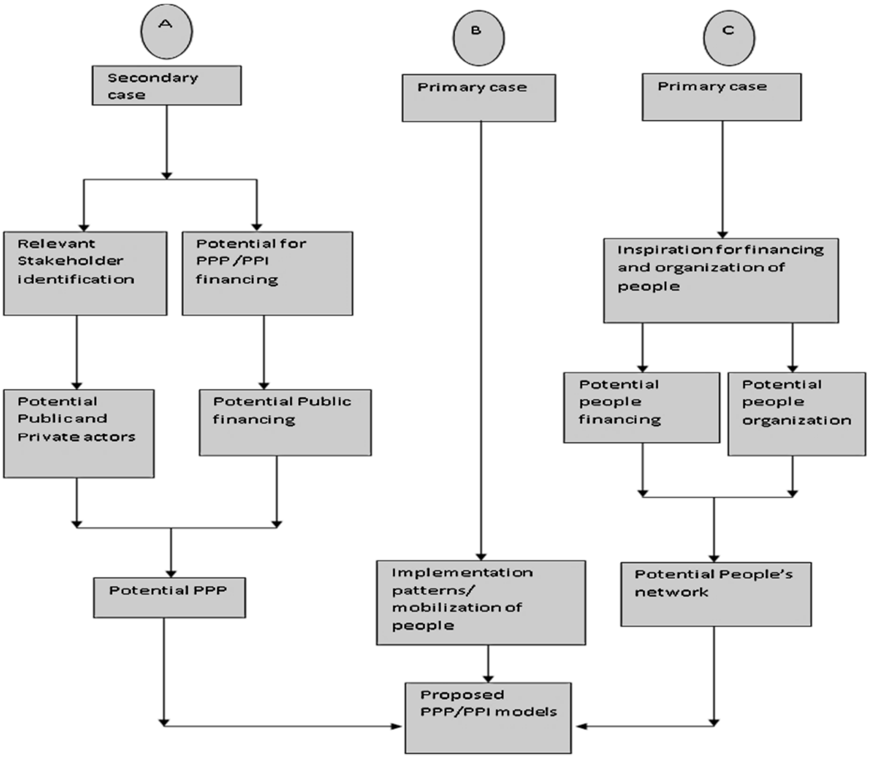


Figure 6- 2 A combination of the Deductive and Inductive Approach for this research

Process A and process C were deductive processes. Process A is described in chapter 10, process B is described in chapter 9 and process C is described in chapter 8. The Stakeholder Theory was adopted for process A and the Actor Network Theory were applied to the primary case study. These theories as mentioned earlier do not possess universal constructs, however, the hypothetical guide to the processes were the core ideas of the theories. There were no spill overs in the analysis of data using these theories. However, a reflection on the use of these theories is discussed in the discussion part of this report. However, the Stakeholder Theory as seen above was used to identify the relevant Stakeholders in the secondary - cases as well as potential public financing initiatives. The end result of this exercise was to understand the current role of PPI as well as use that inspiration for proposing new initiatives without proposing something radically different. The Actor Network Theory was used to retrace the history of the coops with the aim of understanding how they were financed and organized. The end result as seen in the figure above was to understand how people can be organized in the new PPI model.

Process B was an inductive process. This process also occurred simultaneously with processes A and C. This process began with no clear format and provided room for much reflection in the interview process as well as follow emails and phone calls. It is as a result of this induction process that the interviews were semi-structured. The Grounded Theory was used not as a methodology here, but as an analytical tool. The reason for not using it as a methodology was because the primary reason for using it was not to develop theory, but to make meaning of the catalyst that led to implementation and how the process of the implementation of the infrastructure occurred.

The culmination of the three processes led to the proposed models in this report. An interesting highlight of this report was that the whole process would have been an abduction process. This would have been so if the frame of reference was not the researcher's attempt to construct a reality that was a shift away from existing reality. Assuming the researcher's proposition of PPI/PPPs leading to telecom network infrastructure in rural areas were to be validated or explained using only the primary cases, then there is a possibility that an abductive process could have been used.

In the same vein, the process was not retroductive. This was because a conceptual framework was not utilized in this research to understand the boundaries by which PPI/PPP can be used in facilitating Broadband internet in rural areas.

In conclusion, the research was a combination of the inductive and deductive reasoning strategies. These strategies were used to complement each other in the secondary cases only. Induction was used because the researcher wanted to derive meaning that was not constrained by theoretical boundaries. The mobilization of the people was an important part of this report; hence studying existing initiatives required some flexibility in thought.

6.3 RESEARCH STRATEGIES

In the previous section, the word approach and strategies were used interchangeably. This was as a result of the lack of uniformity in most literature on what research approach and strategies are. However, in this section, the discussion is about the method by which the research is conducted. The research strategy is often a product for the purpose of the research. Hence, in this section, the research purpose and strategy are discussed.

6.3.1 RESEARCH PURPOSE

The purpose of a research could either be explanatory, descripto-explanatory or exploratory and this is reflected in the research question (s) (Saunders, Lewis, & Thornhill, 2009). In this section, the rational for adopting the descripto-exploratory research approach and why it was chosen is explained.

A research is exploratory or formulative if the aim is to achieve new insights into phenomena or gain familiarity with the phenomena (Kothari, 2004). The aim is to understand concepts such as “*what*”, “*how*”, “*when*” etc. As the name implies, in this case the problem is not always very clear and the researcher digs deep to find out what the problem is.

A descriptive research describes the characteristics of an actor (s), situations or groups (Kothari, 2004). The descriptive research provides answers to the “what” questions (Saunders, Lewis, & Thornhill, 2009).

An explanatory research provides causal relationships between variables (Saunders, Lewis, & Thornhill, 2009). In deductive researches, this purpose of research is called the hypothesis-testing research studies and in statistics, diagnostic research studies. (Kothari, 2004). The explanatory research answers the “*how*” and “*why*” questions (Yin, 2009). Explanatory researches require some form of analysis to provide answers.

Descripto-explanatory studies occur when a research is a combination between the descriptive and the explanatory purposes of research.

RATIONALE FOR EXPLORATORY RESEARCH

This research is primarily exploratory. The aim is to answer a “*what*” and “*how*” questions. In relation to the research questions, the implicit overarching concept behind the research question is the “*how*” question. It is about “how” PPIs can be facilitated in rural areas to facilitate Broadband infrastructure development? The “*how*” question in this question leads to specificity where the overarching explicit research question is the “*what*” question. The exploration occurred at different levels:

Exploration of the problem: In this research there was an exploration of the nature of the problem of Broadband Infrastructure deficit in rural areas globally, sub-Saharan Africa. Here the discussion in is on what the nature of the problem is.

Exploration for solutions: In the previous section, there is a diagram indicating the 3 simultaneous research strategies aimed at discovering a solution. Here the exploration is on what are the existing solutions and how do these solutions fare in the cases studied.

The reason for adopting the exploratory form of research was as a result of the flexibility provided by the exploratory process. It gave room for reflection on the problem. This was because the problem kept changing. At the beginning of the research, mobile telephony penetration was part of the problem, this research focused on. However the rapid development of GSM in Africa and Europe and

CDMA in the USA and other Asian Standards was a testimony that the market could facilitate mobile telephony. However the same was not the case for mobile and fixed Broadband, hence the prospects for Broadband Internet in Ghana and Nigeria as well as rural areas in sub-Saharan Africa and developing countries was not guaranteed. As a result the focus of the research was narrowed down to facilitating Broadband Internet infrastructure.

The exploration process also gave room for reflection on the solution. This was a daunting process as there had to be constant consultations, reading relevant literature, reflecting on data patterns, learning from conferences, reflecting on implementation patterns in the UK's Community Broadband initiative, gaining ideas from the Swedish policy formulation and practice and attempting to find out if the emerging PPI/PPP frameworks were practical. One would say that the end result of these processes is the fusion of meanings from the researcher and the social actors to construct knowledge.

RATIONALE FOR THE DESCRIPTO-EXPLANATORY APPROACH

To supplement the overall exploratory process, the descripto-explanation research approaches provided a description for the explored findings as well as an explanation for the findings. The description precedes the explanation. To facilitate the research into the explicit research questions mentioned earlier, the "*what*" and "*how*" sub-research questions are explicitly stated. However the rationale for moving from sub-research question one to sub-research question six is the "*why*" research question. The "*what*" question as mentioned earlier is the descriptive bid of the research and the "*why*" and *"how"* questions are the explanatory and analytical bits of the research.

The reason for adopting the exploratory and descriptive approaches is not because they share the "*what*" question. Rather, the descriptive part of the research was important because the results of the exploratory exercise had to be described in the report. This makes the descriptive *"what"* explicit and the Exploratory "what" implicit or tacit. The implicit "*what"* is that which guides the researcher in the field.

CHOICE OF RESEARCH STRATEGY

In adopting a research strategy, it was important to choose that which will handle the implicit and explicit "*What*", "*how*" and "*why*" questions. At the start of the research, the numbers of secondary cases were not certain. The Nigerian and Ghanaian Universality funds were certainties. The initial sets of secondary cases were Nigeria, Ghana and Gambia. However, the contact with the Gambians collapsed; hence the number of secondary cases was reduced to two. Hence, by implication, this research had the potential of being a case study research. This was because there were cases to study. However, having cases were not enough to make it a case-study as the only question they would resolve is the implicit "*what*" question, such as "*what is going on here?*". Hence there would be no "why" or "*how*" questions. The answers to the "*what*" questions would have been suitable for the quest to identify PPP/PPIs in these countries but not in this research. This is because the aim of the research was to understand *"how*" the PPI could be financed and organized. As that was not the case with the secondary- cases, there was a need for the primary -cases. Then the implicit "*what*" responding to sub-question one would be answered. In the process of exploring the "*what*" in the both the primary and secondary cases, the explicit analytical questions of "*how*" and "*why*" would be answered. These factors in the research development process, led to the adoption of the case-study approach. The research strategy, answering the "*how*" and "*why*" questions is some cases identified as the case study approach (Yin, 2009).

In responding to the implicit "*what*" question in the primary case, a supplementary research approach was adopted. This was the Grounded Theory. When supplementing the case study research, it was important to use an analytical tool in the primary cases to research on the "*what"* issues surrounding the research. "*What made them implement the networks?*", "*What were the causal factors to implementation?"* These were examples of some mental questions that came up during the process. To provide a more analytical way of identifying the "*what*" in the primary - cases, an induction process was adopted. This was where Grounded Theory was useful. It was important to also know if these strategies will fit into the exploratory research approach. This was confirmed by Creswell (2009). These strategies of inquiry (Case study and Grounded Theory) are regarded as tools for exploration (Creswell , 2009).

However, the case-study approach and the grounded theory only help to answer part of the research question. However, together, they answer the research question.

6.3.2 CASE STUDIES

A case study focuses on contemporary events, it could be explanatory or exploratory or both (Yin, 2009). Yin (2009) defines cases studies as an empirical inquiry into a phenomenon within the context of real life. It aids in having an in-depth understanding into a real life phenomenon. The types of case studies are primarily single and multiple-case studies, holistic and embedded case studies (Yin, 2009). Case studies include, study questions, propositions, units of analysis, logic linking data to proposition and criteria for interpreting findings. Case studies also provide room for verifying the validity and reliability of data. They can be qualitative, quantitative or mixed method. They can be explanatory or causal case studies, they can be descriptive and they can be exploratory case studies as well. The form of Analysis can be an in - case or cross - case analysis.

APPLICATION OF CASE STUDY IN THIS REPORT

This report is a multiple-case study. The study was divided into primary and secondary case studies. The primary case study was where solutions are extracted to solve the problem in the secondary - cases and the secondary case study was where the problem exists. This implies that two multiple-case studies were conducted.

Primary Case Study: The diagram below presents the structure of the primary multiple-case study. This was an effort to answer sub-research question two. The context of the primary cases is the identified PPI/PPP approaches and bottom-up around the world. The Ghana Wireless Project was documented because it was a bottom up-project and it existed in Ghana. It proved that bottom-up initiatives in rural areas are possible, if supported. The primary case study was divided into three contexts. The developed country context, the developing country context and the municipality led Initiative. The reason for this division was because of the differences in what was described as rural areas, the socioeconomic conditions of each context and the possibility to see if a pattern could emerge along these contextual lines.

The cases in the developing country sub-contexts were: the Ghana Wireless Project (Ghana), Dharamsala Wireless (Airjaldi India), and Johannesburg Wireless User Group (South Africa). The cases in the developed country sub-context were: the Magnolia Road internet Coop (USA), Hallaryd Broadband Coop (Sweden), and Djurslandsnet (Denmark). The case of the municipality - led initiative was the Almhult Municipality Broadband initiative (Sweden). The reason for separating the Swedish case between the coop and the municipality was because the municipality initiative consisted of eight other co-ops as well. Secondly, it was possible to analyze the Hallaryd case separately to understand how they were organized and financed.

In the context of the developing countries, the unit of analysis was an anonymous respondent working for the Ghana Wireless group. The decision to be anonymous was based on the fact that the respondent would provide more details to issues raised. However, the interview attached to this report is censored and the contentious issues not reported, but the respondents wish is being respected. In the case of JAWUG, the unit of analysis was the chairman of the group. In the case of Airjaldi, the units of analysis were the founder and co-founder and current chairman of the social enterprise.

In the context of the developed countries, The unit of analysis for MRIC was a board member and co-founder of the coop. The units of analysis of DjurslandsNet were the former chairman and founder of the coop with a volunteer. The unit of analysis for the Hallaryd Broadband coop was the treasurer of the group.

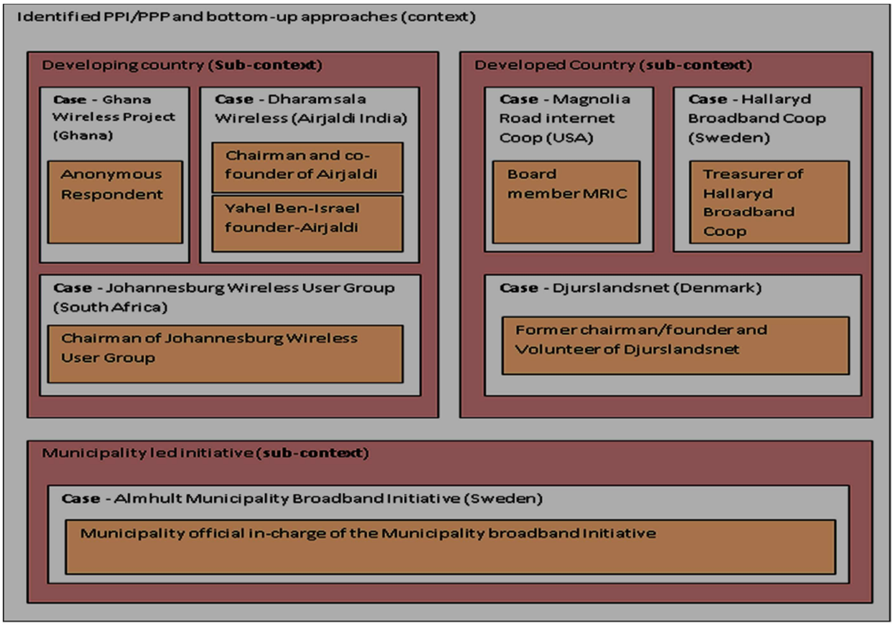


Figure 6- 3 Multi-Case Study 1

In the context of the municipality led initiative, the unit of analysis was the municipal officer in charge of the project, who is also a chairman of one of the coops.

Secondary Case Study: The diagram below presents the structure of the secondary multiple-case study. This was an attempt to answer sub-research question one.

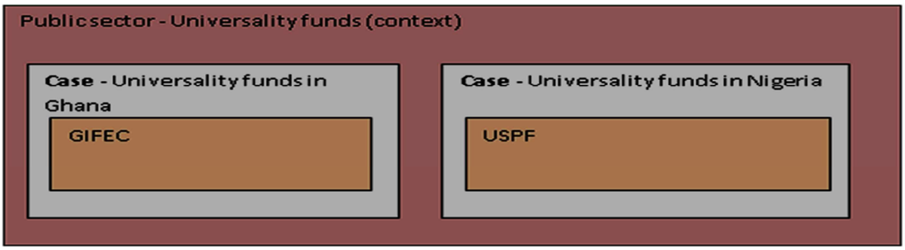


Figure 6- 4 Multi-Case studies 2

The context of the secondary cases was the respective public sector - universality funds. The cases included the universality funds in Nigeria and the universality funds in Ghana. The unit of analysis included the Director of Communication, GIFEC, Ghana and the Secretary of the USPF in Nigeria. Data gathered from them were supplemented with secondary data.

<u>CASE STUDY PROCESS IN THE STUDY</u>

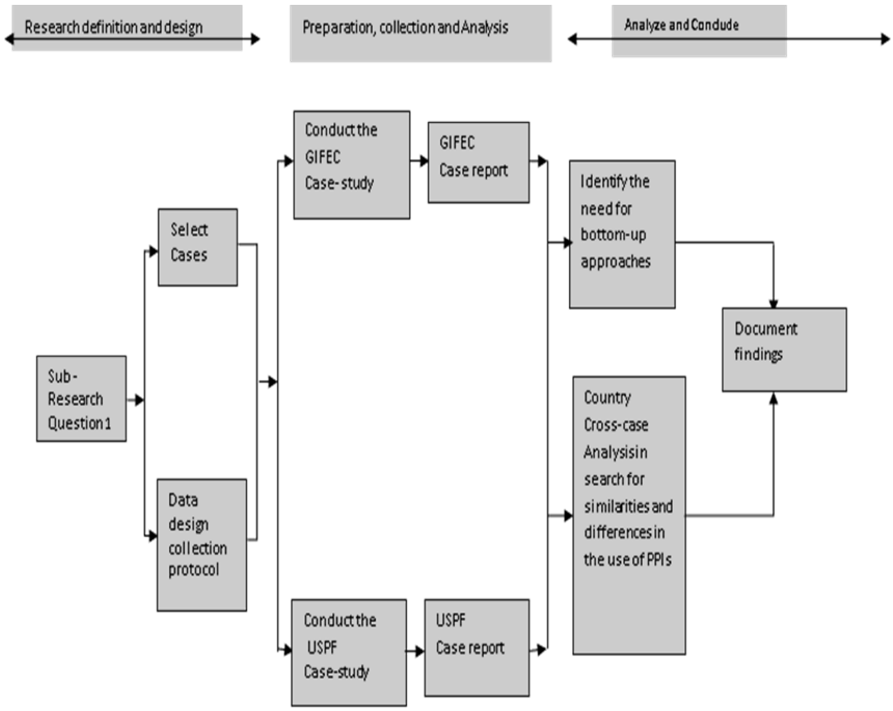


Figure 6- 5 Actual applications of the Secondary Case study

Inspired by (Yin, 2009)

The diagram above represents the sequence of events in this research process. Logic building and analysis occurred under the preparation, collection and analysis phase. In this process, the Stakeholder Theory was applied as a way of describing the cases. The actual case study involved the use of qualitative data gathering techniques that will be discussed later in this chapter. The idea behind the first case study was to provide an answer to a sub-research question 1. Hence the findings were documented and reflected upon. It was the reflection on the secondary case findings and the chance meeting with Dr. Lemstra, which led towards searching for bottom-up approaches as a supplementary PPP/PPI approach, leading to Primary case study presented in the figure below. The sequence of the primary case study is presented below.

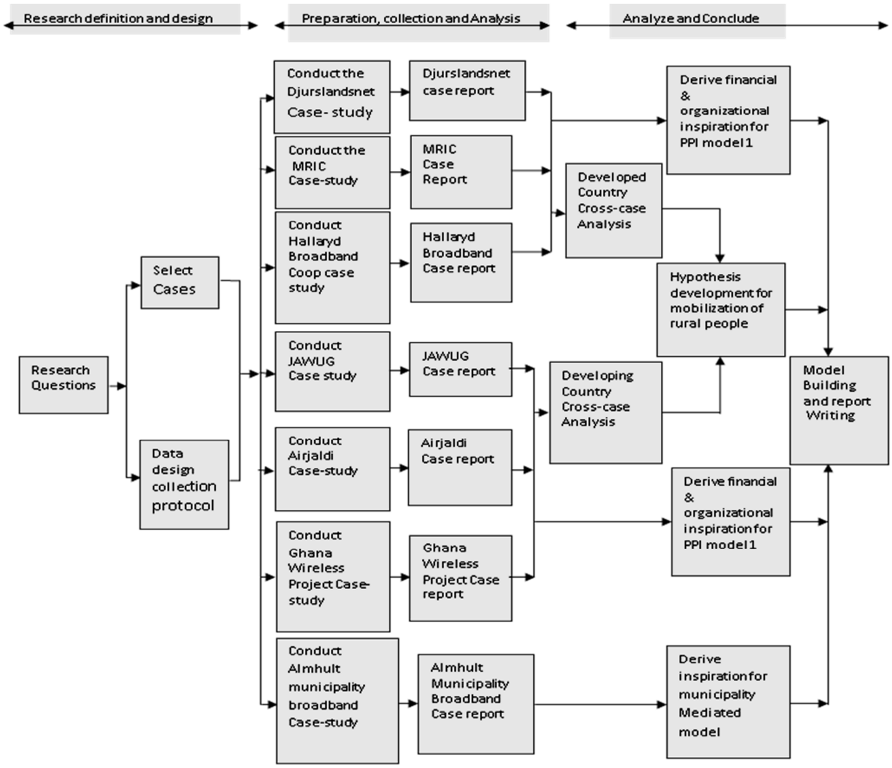


Figure 6- 6 Actual Application of the Primary Case Study

Inspired by (Yin, 2009)

The Actor Network Theory (ANT) and the Grounded Theory analytical tool were used to describe simultaneously describe as well as analyze the cases respectively. The adoption of Grounded Theory was a means of validating the ANT as well as capture theoretical spill-overs from ANT. In a more significant way, it was a tool for generating the hypothetical models as seen in the diagram above. It was also data gathered from the Grounded Theory exercise that was used for the cross-case analyses. The data gathered from the ANT were fluffy and highly generalized and this led to a high level of subjectivity. Hence the understanding of the implementation process in the primary cases had to be done via Grounded Theory. However, from the ANT, the organization and the financial arrangement of each case emerged. In the tenth chapter of this report, a cross case synthesis in the primary case study of the ANT findings was made to produce the two PPI/PPP models as well as propose, financial and organizational arrangement of the models. The outcome of the Grounded Theory exercise produced models that could be used to mobilize rural dwellers in developing and developed countries in general to facilitate Broadband Internet infrastructure. This process provided answers for research questions 3, 5, 6.

However, it was important to know if these proposals would be applicable in Ghana and Nigeria. Still in the tenth chapter of this report, a cross case synthesis was done based on the reported findings as seen in the diagram below. The outcome was the plausibility of implementation.

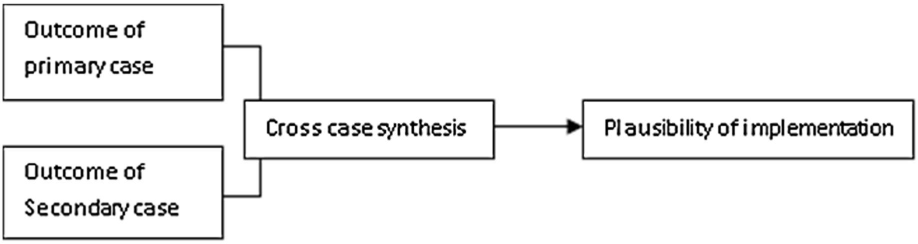


Figure 6- 7 The Synthesis framework of the case study Results

6.4 METHOD

Saunders, Lewis & Thornhill (2009) identifies the research method as the research techniques, procedures used to obtain and analyze data. The methods could be Mono method, mixed method and multi methods (Saunders, Lewis, & Thornhill, 2009). The mono method set of research technique and procedure is used for this report. As mentioned earlier, this is a qualitative research method, hence a mono-method. This implies the collection and analysis of qualitative data. Qualitative data are mostly interpretivist in nature, it is analyzed via conceptualization (Saunders, Lewis, & Thornhill, 2009). In this section, the discussion is on the Sample investigated, the data sources, data analysis, validity assessment, reliability assessment and ethical considerations. The unit of analysis and the strategy of inquiry was discussed earlier, hence there was no need to repeat it in this section.

6.4.1 POPULATION AND SAMPLE

The overall major sample size of the research was nine institutions. Two of the institutions were in the primary case studies and the remaining seven institutions were part of the secondary case studies. The majority of the cases had subscriber bases that were not below 500 subscribers. However, the subscriber-base of the Wireless Ghana project was not revealed. The sampling procedure is shown in the table below.

Table 6- 5 Sampling Procedure for the cases

	Unit of Observation	Sampling	Organization
1	Djurslandsnet (Denmark)	Snowballing	
2	Hallaryd Broadband (Sweden)	Purposive	Broadband Co-ops
3	Magnolia Road Internet Coop (USA)	Snowballing	
4	JAWUG (South Africa)	Snowballing	
5	Dharamsala (India)	Snowballing	Social enterprise/Formerly NGO
6	Wireless Ghana (Ghana)	Snowballing	NGO
7	Almhult Municipality	Purposive	Municipality

Williams (2015)

All the cases were identified via snowballing and purposive sampling. The researcher only knew of cases in South America. However, due to language barrier, it was impossible to investigate those cases. However, DjurslandsNet was introduced to the researcher via Dr. Lemstra and Vic Hayes of Delft University. Reza Tadayoni from Aalborg University, who is a co-supervisor in this research, knew about the Hallaryd and Almhult case. The other cases were identified online using Google Search. There would have been more cases, but there was no response from most of those contacted.

However, an effort was made to get at least cases that could be situated either as a developed or developing country cases. The initial intention was to get at least 5 cases per continent. But that was not possible. The weakness in the interviews is that the number of interviewees in each case were few. In the primary case study, aside the case of DjurslandsNet and Airjaldi (Dharamsala Network owners), with two respondents, the other cases had one interviewee each. The reason for having just one was because these were either the co-founders, Board members or hands on personnel (as in the case of Wireless Ghana Project) who were incidentally at present at the formative stages of the organizations interviewed. Hence, they were able to provide the needed information about the formative process of the organizations. In the case of DjurslandsNet, efforts to get in touch with the current chairman of GrenaasNet, one of the breakaway networks failed. In the case of the Broadband coops in Sweden, contact was made to other coops but there was no response. However, as luck would have it, the municipal officer in-charge of the project happened to be a chairman of one of the coops. It was from him, that insight into other coops was assessed. In the case of Magnolia road, Internet coop, there was an attempt to get in touch with Rob Savoy but this did not work out. However the depth of information gathered was sufficient to trace the patterns. In the Secondary case study, there was heavy reliance on documents sent by GIFEC in addition to the Communications Officer at GIFEC Ghana. He is the one that deals with the public and only refers you to other respondents, if needed. However the telephone conversations were brief and were only utilized to get clarity on questionnaire answers and on aspects of the document sent. In the Nigerian case (USPF), it was mostly a questionnaire response, and secondary data from the USPF website which was quite exhaustive, gazette regulations and the annual reports. Academic material was also used to supplement this.

6.4.2 QUALITATIVE DATA SOURCES (RESEARCH TOOLS)

The data collection tools were interviews, document and video reviews, emails, and observations and questionnaires.

INTERVIEWS

The interview frame for each case is revealed in the table 6.6.

Case Study 1

Table 6- 6 Interview Duration for Case Study 1

	Country	Person interviewed	Designation	Mode of Interview	Duration
1	Djurslandsnet (Denmark)	Bjarke Nielsen	Founder/Former chairman Djurslandsnet	Face-to-face interview	8 hours (4 hours per day)
		Stephen	Former volunteer		
2	JAWUG (South Africa)	Neil Govender	Chairman JAWUG	Skype video Interview	45 Minutes
3	Airjaldi (India)	Jim Forster	Chairman/Co founder Airjaldi	Skype video interview	50 Minutes
4	Hallaryd Broadband	Asa Dahlstrom	Treasurer, Hallard	Face-to-face	54 minutes

	Coop		Broadband Coop	interview	
5	Almhult Municipality	John-Arne Sandström	Municipality Officer in charge of the project	Face-to-face interview	1:14 hours
6	Wireless Ghana	Anonymous		Skype video interview	1:05 hours

Williams (2015)

In the case of the Ghana Wireless Project, the respondent did choose to become anonymous. As seen in the tabular presentation above, interviews did not play much role in the primary cases. This was because the respondents were important government officials. As a result, they had limited time, hence data gathering for them had to be designed in a way that they can respond at their convenience.

There were other informal face-to-face interviews with John Kibuuka, IT personnel from East Africa. The aim of the interview was to discuss with him the findings in the cases mentioned here and how it would operate in East Africa. He has had experiences in setting up telecentres in parts of Uganda and Tanzania. The interview with him was highly unstructured.

The interview styles were a mixture of both semi-structure open ended interviews, unstructured interviews and informal interviews. Before conducting the interview, the themes of the interviews were sent a forehand by email to the respondent. This was aimed at ensuring that the adequate information on the unit of investigation was preserved. The lengths of the interviews for the secondary case study were determined by the unstructured part of the interview. The semi-structured interviews for the secondary cases were designed to respond to the ANT related question. The ANT related questions were facilitated using Michel Callon's framework mentioned earlier in the theoretical framework section.

The unstructured part of the interview emanated from asking the respondents to provide an account of how the organization began. In some cases, the ANT framework was satisfied without the questions being posed to the respondents. In other cases, the questions were posed. However, the interview process was free flowing and unscripted follow questions followed in the line of thoughts that were new, unclear or thought provoking. However, it was important for the researcher to get an answer to how they are organized and financed and if these arrangements have evolved over time and why.

The unstructured interview provided insight into the respondent's backgrounds, their beliefs, convictions and their general world view as well. It provided a great deal of information that would help the induction process. Ultimately, the interview sessions are what brought the conviction that people in rural areas – if they want to can facilitate Broadband Infrastructure in rural areas. It was a finding of "where there is a will there is a way".

Among the data, techniques used, this was the most effective as the feedback from the respondents was immediate. The face-to-face meetings were more efficient as one could access the body language of the respondent to ascertain when to stop, continue or if the respondent is comfortable with the question asked.

Case Study 2: In the Nigerian case, conducting an interview was not possible due to proximity and logistical challenges.

Table 6- 7 Interview duration for case study 2

	Country	**Person Interviewed**	**Mode of Interview**
1	Ghana	Communications Director GIFEC	2 Separate telephone interviews
2	Nigeria	Non	Non

Williams (2015)

In the Ghanaian case, the interviews were impromptu and were very informal. However, permission was received to cite the conversations. These interviews were followed up to the response from the questionnaires and documents.

DOCUMENTS, SOCIAL NETWORK, VIDEO AND EMAILS

Documentations played a major role in this research. This was evident in the primary and secondary case studies. In the primary case studies, GIFEC provided documentation on their projects, their vision, their administration and their scope of operations. Documentation from the Nigerian case came mostly from the USPF's well documented website. Here they do not only list their projects, but explain their implementation process, the forms of PPP, how it is carried out, what the USPF stands to gain and why they need the bottom-up initiative.

Documentation also played a role in the secondary cases. Documentation, emails and linked in played a major role in understanding the early development of the Dharamsala Network and the Magnolia Road Internet Coop in the USA. In the case of the Magnolia Road Internet Coop, an interview was scheduled, but the major contact persons, sent the organizations diary and other supporting documents. The idea was to arrange an interview, if there were followed up queries. This did not occur because the follow up emails were promptly responded to and detailed; few questions on LinkedIn were also responded to rapidly. Hence, establishing a Skype video link was not necessary.

In the case of Airjaldi, Yahel Ben-David, the founder of the network sent a YouTube video of a 21 minute talk he delivered TED Conference. He also sent other valuable documents as well that gave an insight to Airjaldi. As he was not actively involved in the project anymore, he connected the researcher to Jim Forster, the current chairman and Cofounder of the Airjaldi.

There were lots of emails and documentations that were not related to the cases studied, but other cases mentioned in this report. This report is rich in information, gathered from documentations and Emails. There were also very valuable email exchanges and documents from John Davie, Chairman Altra Capital UK, Amos Nungu, head of the National Centre of Excellence in ICT, Tanzania. Both provided information on PPP and ICT for rural development project, funded by the Swedish International Development Cooperation in Tanzania. The communications were via email. There were also documents from Open Signal, recommended by a respondent from MTN Ghana, the largest telecom network in Ghana. The document provides signal data of mobile Broadband coverage in Nigeria and Ghana.

OBSERVATIONS

Observations were both on-site visit and the following of the trend of events. In the early parts of this research, practical observations were made by visiting some rural areas in sub-Saharan African countries such as Nigeria, Togo, Benin and Ghana in West Africa in 2011 to verify the problem. Another observation was made in Tanzania in East Africa in 2014 to also verify the problem. In the seventh chapter of this report, a clear explanation of the process is described.

There were also visits to Grenaa in Djursland in Denmark. Here an inspection was made of the infrastructure, server room and some installations. This was during the interview breaks. A visit was also made to Almhult in Sweden in the face to face interview. On this trip, there was an opportunity for the researcher to see the roadside that was dug, with fiber optic cables laid out.

The researcher had also observed the CBN project in the UK as well as read about other Broadband coops. These observations did provide points of reflection for this report. It was one of the reasons, this research adopted the point of departure from Public facilitated and owned co-ops to total coop ownership.

QUESTIONNAIRE

The contribution of questionnaires to this report was very negligible. However, it is mentioned here because some of the information gathered from the questionnaires, provided useful information. The initial idea of adopting questionnaires was because; there was a possibility of this research becoming a mixed-methods research. The questionnaires were closed-ended. The reason was to get answers from a preferred dimension (PPP) (See (Reja, Manfreda, Hlebec, & Vehovar, 2003)). The questionnaire design was facilitated by the ANT and Stakeholder Theory.

The questionnaire distributions were first the universality funds in Nigeria and Ghana. The essence of the questionnaire was to find out if they know about PPPs, how they have used PPPs in the development of Broadband Internet infrastructure (Wireless Broadband), if they had not used PPPs, why was that so and if they were in favor of using PPPs to develop wireless infrastructure in rural areas of their domain.

Another pre-test questionnaire was developed for 80 Internet Service Providers in Ghana. The essence of the questionnaire was to test the PPP readiness of the internet Service Providers as well as understand what would make them deploy in rural Ghana.

The Universality funds in both Nigeria and Ghana did respond to the questionnaires. The Secretary of the USPF in Nigeria responded to the Nigerian case. The Communications Director of GIFEC in Nigeria responded to the Ghanaian case. However, only 3 of the Internet Service providers responded to the questionnaire. Hence it was difficult to design a follow-up questionnaire for them. However, the response from the universality funds were in the affirmative to the use of PPPs as they knew about it and were in search for more efficient ways of adopting it.

Hence the use of questionnaires was relevant in getting response from the Universality funds and the three Internet service providers

6.4.3 DATA ANALYSIS AND INTERPRETATION TECHNIQUES (PART1)

As mentioned earlier, qualitative forms of data were analyzed and interpreted in the bid to respond to the research questions. The raw data were transcripts, field notes, texts, videos, voice recordings, pictures (from documents and on the field). The voice recordings and video were transcribed manually. The strategy of analysis and interpretation of the primary studies was deductive, using the Stakeholder Theory. The strategy for analysis of the secondary case was divided into two phases. These were the deductive and deductive processes.

DEDUCTIVE ANALYSIS AND INTERPRETATION WITH STAKEHOLDER ANALYSIS AND THE ANT

The field notes, texts were studied from an interpretivist/constructivist standpoint guided by the ANT (for the secondary case study) and the Stakeholder Theory (for the primary case study). This was done to identify the components of each theory as well as make meaning of the findings from these theoretical perspectives. The pictures were not very relevant. The videos had to be transcribed to give the researcher the opportunity to carefully analyze the text. The respective descriptive frameworks were used to provide a thematic descriptive analysis of the cases based on the research questions.

INDUCTIVE ANALYSIS AND INTERPRETATION WITH THE GROUNDED THEORY ANALYSIS

Here, the field notes were studied differently. There was more scrutiny of the overall data that was collected in the process. Data coding had occurred before now and patterns were beginning to emerge. There were duplicate data outcomes from documents, and transcribed interviews, hence it was important to match the codes from the documents and those from the interviews in order to do away with duplicates in the process. In many cases the respondents gave more insights in the interviews, hence the interview codes were chosen and the documents used to validate the transcribed interviews. As the documents, interviews and previous codes were being read through; reality was formed in the researcher’s mind, implying idealism. Idealism was stronger here than in the deductive process because in the deductive process, reality was created by the theories being used. The theories shaped how the interview questions were viewed.

However, data were coded to understand the process of implementation in secondary case studies. They were grouped under Developed country, Developing country and public sector contexts. The single cases were coded individually and later the contextual cross coding took place as well. An attempt was also made to code for a grand hypothetical model.

DEVELOPMENT OF PPI MODEL

The Development of the PPI Models was inspired by the data interpretations from the Secondary Case Studies and the Primary case studies. The Data from the secondary case studies, using the Grounded theory showed how the people can be mobilized to facilitate Broadband Internet infrastructure. Data from the ANT provided inspiration on how the new models can be financed and organized. The Data from the Primary case studies, using the Stakeholder theory provided an outlook into how PPIs are presently organized in the primary cases. Data from this process also showed the need for bottom up process.

6.4.4 GROUNDED THEORY ANALYSIS (DATA ANALYSIS AND INTERPRETATION PART 2)

This section describes the Grounded Theory process in this report. The Grounded Theory tradition adopted here was that of Strauss & Corbin (1998). The reason for adopting this tradition for the analysis was because they did show how to "*code for process*" as mentioned earlier in this report. They define process as "*sequences of evolving action/interaction, changes in which can be traced to changes in structural conditions*" (Strauss & Corbin, 1998). This definition provided implied that the process of an event could be traced using this medium. As mentioned earlier, the Grounded Theory approach was used to understand how the PPI/PPI and bottom-up initiatives took place in the primary cases.

GROUNDED THEORY PROCEDURE

This section is divided into two subsections. The first section described the pre-coding session and the second section describe the coding session.

Process 1: Pre-Coding Procedure

The pre-coding section describes the sources of data, the ideas that were preconceived and the reflection process.

Sources of Data: The first step to this process was to group data gathered from the field into the cases where they fit. Data from the primary cases were mainly case interviews, supplementary documents received from the social actors in each case, emails exchanged as a means of follow up questioning, information from the web pages of cases with web pages and video data. Video data were received from Yahel Ben David. More on the data collection techniques are discussed in this chapter. However, the Grounded Theory proposition by Strauss & Corbin (1998) unlike the other traditions, did not totally write off the influence of pre-conceived notions and theory of the Grounded theory process. However, they were of the opinion that it should be minimized. However, theoretical ideas were not employed in the process. However, in naming the variables at the very end, there were theoretical influences. This was why one could see words like "perceived usefulness".

Preconceived notions: Hence, before proceeding, it is necessary to indicate that although the interviews were without many preconceived notions-excluding the structure provided by the ANT, there were certain questions that were influenced by these pre-conceived notions. The preconceived notions did not shape the interview, but was a reservoir for follow up questions to find track down information that might have been left out in the technical description of the process. The preconceived notions were from three sources:

- **Previous data gathering efforts in the research process**: Actual data gathering began not necessarily from the secondary - cases, but from the initial sample set at the start of the research. These samples set consisted of small Internet Service Providers in Ethiopia, Zimbabwe, Kenya and Nigeria. This occurred before knowledge of the secondary - case. Their idea was to find out what they are deploying in rural areas and what was the best technical solution for rural Africa. The idea was to have an idea of a technical solution by which a PPP could facilitate. Data gathered from this process was from emails a Skype call and Skype textual conversations. These data were not coded, but it provided room for reflection of what was the best solution for rural areas. The propositions gathered from these small ISPs were similar to those identified in the secondary cases. However, the nature and purpose of deployment were different as one was commercial and the other was not. One would not also write off.

- **The search for PPP and PP**I: This preconceived notion was from literature. Here there were questions aimed at understanding the role of the Public sector and the profit making private sector in the implementation of the infrastructure in the secondary - cases. The essence of these was to get answers to the research questions. However, it is important to state once again that this exercise was not meant to skew the investigations in one direction, but to make sure that in the midst of the data gathered, the answer to the research questions can be found.

- **Technology Acceptance Model**: In naming the variables, it will be evident that some variables bare semblance to that of the Technology Acceptance model (TAM) by Davis (1989). Such variables would bear verbs such as "*Perceived*." An example is "*perceived usefulness of technology*". TAM did serve as a source of inspiration in naming a few of the variables in the coding process. However, TAM did not influence the theoretical sampling process.

Reflection process alongside data collection: This was the process where data were reflected upon before it was coded. The actual coding process began after data from the first primary case, Djurslandsnet were collected. The reflection process was to understand the process that occurred in Djursland. This process involved the writing of loose memos to document the line of thought of what was thought about the process. The reflection process was not a micro-analyses, but the attempt to find out "*what was going on here?*", "*Did PPP/PPI play any role*?" "Is this possible to replicate this initiative in Nigeria and Ghana?"

The reflection process shifted the thought of the researcher from the initial pattern of speaking with the private sector to looking for more bottom-up solutions. The bid to dig deeper into what was happening in the cases led to the coding process for

Djurslandsnet. The coding process, which included much of producing memos on clip of papers, produced a deeper insight into the data gathered. Another form of producing memos occurred simultaneously as the interview went on. The essence of these memos was to capture new thoughts not considered in the preparation of the interviews. This led to follow up questions. At this point it is important to note that in the final analysis; most of the memos were discarded. This was because some led to nowhere.

Hence, as data was collected, memo writing and coding took place as well. It is the result of the reflections and the open coding that provided more questions for the subsequent cases. Hence, in this manner, while conducting interviews, there was a form of mental comparative analysis between the cases to sort of find out social, economic and cultural patterns. If the patterns were similar then “why,” questions were posed to the interviewee to ascertain, if the causal factors were the same or different from the cases being compared. The comparisons were documented at the end of the interview as memos, to avoid it being forgotten. If they were different, why were they different? In this manner, the respondents were able to provide answers to what they omitted in the course of the conversation.

This reflection and coding process occurred through the other cases. Let us now discuss the coding process used in this research. The process was facilitated in three stages. These were the single case analysis, contextual cross-case analysis and cross - context cross - case analysis. The coding process for the single each case analysis included open coding, axial coding and selective coding.

Process 2: Coding Process

In analyzing the data for the cases individually the coding process was the Open, Axial and Selective coding process. However, at the selective coding stage, cases were also merged along contextual lines and in general. The process of producing the general model is referred to by different names in other Grounded Theory traditions. In other traditions the final stage of theoretical abstraction is called Theoretical coding (Glazer, 1992) (Charmaz, 2006). The coding tradition adopted in this report follows the Strauss and Corbin (1998) tradition.

It is important to note that the Second and third stages are independent of each other. The third stage was only adopted to produce a general, Grounded Theory hypothetical model. The second stage was aimed at identifying individual Grounded theory Models for each context. Although the thought pattern of the second stage did influence the third stage, they were independent and not necessarily connected. This is why in the rest of the report, there is more emphasis on the contextual models.

Open Coding: Since this was a process coding exercise guided by the Strauss and Corbin (1998) tradition, there was no coding for dimensions and properties. The guidelines for the coding for process by Strauss and Corbin (1998) is in search for action/interactions (page 163). As Strauss and Corbin put it, the search was for "What is the process?". This was the central question that guided the coding of documents, interviews, transcription and coding of videos, etc. The "central theme" here was the implementation of the Broadband infrastructure. Hence the process coding was to search for causalities that would lead to implementation. Although the search was for PPI/PPP, it was necessary to allow the data speak with regards how the infrastructure was implemented. In the process, the PPI/PPP would emerge or not. Otherwise, if a PPI/PPP was not evident or played a very minor role in the process, that would have been the end of the process. However, if the coding was to understand the Implementation process, if a PPI/PPP was not evident, it would be clear if it were necessary or if the actors clamored for it at a certain point.

Based on this line of thought, line by line coding, sentence by sentence, phrases, and thematic coding were employed in the process. The reason for adopting all of these forms of coding were used to search for keywords or phrases that would denote causality, action/interaction. Examples of how this coding occurred are expressed below.

An example of a sentence coding: This can be found in the interview coding for JAWUG in South Africa, there was a sentence that went thus:

"*Kieran Murphy and Co were university students studying computer science*"

This sentence was interpreted as "*technical knowledge*" as they learnt about the deployment of Wi-Fi from their studies. Hence, when they got to the point that they could program and play Games, they knew how to facilitate it online.

An example of a phrase coding: An example can be found in an interview with the Almhult Municipality. There was this phrase:

"*..Tele2 is the Gateway to Almhult…*"

The Keyword here was a "*Gateway*".

An example of thematic coding: The context of the quotation below denotes Public-Private Partnership. This was part of an answer to the question, bordering on Swedish regulation permitting public involvement in telecom infrastructure development. In this case, the municipality had a partnership with Zitius a Private company. Hence this sentence was viewed from the thematic point of view. The sentence was thus:

"It is allowed, but it is allowed, but we should look out every 3 years to see if there is a private company can play that role".

This was interpreted as "Municipality relationship with the private sector". The open coding was performed individually for the 7 primary cases. The table below presents the used open - codes, which were mostly from the interviews.

Table 6- 8 Number of Open Codes for each case

	Case	**Number of Open codes**
1.	DjurslandsNet (Denmark)	256
2.	MRIC (USA)	53
3.	JAWUG (South Africa)	75
4.	Dharamsala (Airjaldi India)	88
5.	Almhult Municipality (Sweden)	120
6.	Hallaryd Coop (Sweden)	72
7.	Ghana Wireless Project	92
	Total	756

Williams (2015)

A minimum of 756 open coded were derived from the 7 primary cases. These codes were concepts that were key words, phrases or short sentences.

Axial Coding: Once these open codes were derived, the next phase was to group the codes into categories or cross-code. The essence of categories in general, according to Strauss and Corbin (1998) is to understand, "What is going on?" To facilitate categories, here one identifies concepts with common properties and classify them (Strauss & Corbin, 1998). However, Strauss and Corbin (1998) explain that coding for process involves searching for "..Happenings and events, that may or may not occur in continuous forms or sequences" (Strauss & Corbin, 1998). Hence, in the bid to form categories, implicitly, the common properties of the open codes or concepts indicting, happenings, events and causalities guided the process. This was a challenging process; hence the first step was to ignore the happenings, events and causalities to group the open codes by properties. This way of grouping led to sub-categorizations, but sharpened the concepts until; there were emerging events, happenings and causalities. However, in this process, the initial open- codes that were not related to events, happenings and causalities were discarded. The table below presents a summary of the categorization process.

Table 6- 9 Number of Axial codes for each case

	Case	Sub category 1	Sub category 2	Number of categories
1.	DjurslandsNet (Denmark)	216	80	59
2.	MRIC (USA)	41	27	21
3.	JAWUG (South Africa)	23	20	14
4.	Dharamsala (Airjaldi India)*	16		12
	Dharamsala (Airjaldi India)**	61	24	10
5.	Almhult Municipality (Sweden)	46	15	20
6.	Hallaryd Coop (Sweden)	48	22	19
7.	Ghana Wireless project	60	29	22
		511	217	177

Williams (2015)

The sub-categories were not necessarily unique. Some categories shared more than one sub-category. An example can be seen in the case of Air-Jaldi. The existences of anchor tenants were coded as “Potential commercial incentive to invest” which was grouped under the main category of “supply assessment”. Anchor tenants were also seen as the potential demand. It was grouped under “identified demand”. This was because the demand was identified by the investors. “identified demand” was grouped under “demand assessment”.

As seen in the table above, there were two sub-categories and one main category. This was not pre-determined, rather it was coincidental. However, the process of refining and categorizing the codes to the point of saturation reduced the first sub-category to 511 codes. This was further reduced to 217 codes as certain sub-categories were seen to share similar properties. An example can be seen in the case of Air Jaldi where user need assessment, perceived demand, identified demand and

Actual User demand were sub-category 2 codes. While going back to the interview to understand why these codes existed, it was evident that the investors conducted a demand assessment. Examples of the phrases that led to this assessment were:

"*People want to talk*"= "*Potential User Demand*" = "*identified demand*"

"*Tourist in Dharamsala need internet*" = "*Potential User Demand*" = "*Perceived demand*"

"*We assess the economic activities of the areas*"= "*User need assessment*"

"*Yes, the private school system which consisted of 13000 schools across India, they had ICT teachers, so that was helpful*" = "*Actual demand*".

These are examples that implied that they did carry out some form of demand assessment. It was at the point of category saturation, that causal factor, events and happenings began to emerge from the Axial coding process. Hence in each case, it was now important to link relevant categories around the central Theme or code. This was where another form of reflection occurred where one had to identify the causal factors in each case and how they led to implementation which was chosen earlier as the central theme.

Selective Coding: The selective coding process occurred in three stages. The first stage was to produce selectively code the individual cases. The second stage was to perform contextual selective coding and the final stage was to perform a general selective coding. The essence of this exercise was to understand the patterns in each case, understand the patterns in each context and to have a general overview of a unified model or pattern. As mentioned earlier, the aim was to understand the causal factors and the happenings and events which were the intervening variables to the central phenomenon (implementation). In a normal grounded theory process, there is no need to perform selective coding for context. But this was necessary for the analysis in this report as it provides answers to research question 2 and 3.

Selective Coding for the individual cases: This is a process where relationships are sought between the central phenomena and the main categories for each case. This leads to the construction of a story line around the core category (Strauss & Corbin, 1998). This was done for each case. The selective coding process in this report as seen in the appendix (appendix I) was done diagrammatically to represent the identified relationships for each case. The reason for the use of diagrams was because; it was clear that in almost all the cases, there were mini-processes that culminated to the grand-process. Hence it was necessary to showcase what went on there and how it affected the final implementation process. The use of diagrams alongside memos is encouraged by Strauss and Corbin (1998), however, they argue that the use of diagrams should be used throughout the process if utilized (Strauss & Corbin, 1998).

As in the open and axial coding process, every emerging category from the Axial coding process was not utilized in the selective coding procedure as they had nothing to do with the process of implementation. An example is identified categories which signified the break-up of a large network, as in the case of Djurslandsnet. Another example is the category identifying the reason JAWUG could not secure public support. These matters were irrelevant to the coding process as these organizations were still able to implement in the face of these challenges. However, these unused categories did help in further in the final analysis when the PPI Models for this report were considered.

The relevant categories were grouped under causal conditions, action/interactions and the central Phenomenon. These categories were identified in the Axial coding process for each case. The selective diagrams represented this process.

Selective Coding for Contextual Cross-Case analysis: Once the individual selective coding process was done, the next stage was to carry out a contextual selective coding process as a way of contextual cross analysis. Here the cases were divided into three contexts as seen in the table below.

Table 6- 10 Contextual grouping of the cases

	Developed Country	**Developing Country**	**Public Context**
1.	Djurslandsnet (Denmark)	JAWUG (South Africa)	Almhult Municipality
2.	Hallaryd Broadband (Sweden)	Dharamsala (India)	
3.	Magnolia Road Internet Coop (USA)	Wireless Ghana (Ghana)	

Williams (2015)

These were the developed country context, the developing country context and the Public sector context (developed country context 2). The idea here was to develop hypothetical models that can be used not only to explain the Broadband infrastructure implementation process in each context, but to identify these models as models worth being used in rural areas within each context to mobilize people. The same strategy used in the selective coding of the individual cases was used here but differently. The cases in each context were analyzed at the axial coding stage. The reason for this was to search for commonalities among the causal factors, action/reactions and how they relate to the central phenomena. The reason for choosing the axial coding stage was because the categories were self explanatory. However, in many cases, there was the need to go back to the interviews and documents as well as the open codes to verify if an identified causal condition for an action was true. In some cases, this led to the modification of the names of the variables "recoding", if the initial coding was deemed inadequate.

In order to abstract the selective codes for each context, the baseline was that the emerging models should be universal in nature. It should be able to cater for the poorest of the poor communities around the globe both developed and developing countries. This line of thought was not extended to the public context because it has been just one case and the selective coding was enough to build a story around it. Based on this line of thoughts, the commonalities had to be grouped into themes. The themes were developed around the frequency of occurrence of a category. An example was the presence of "Vital Resources", the differentiation of usefulness and "scarcity." These themes were common and they often led to an action, which was either a mini-implementation or trial or Mobilization of people. Hence abstracting these concepts from their case environment to the contextual environment, it was clear that these causal factors did produce some action/interaction which produced the event, which was the process. If the models were to be tested anywhere, the open-nature of these variables provides any researcher the room to search for the existence of these factors within the context of research.

In this manner, the commonalities in each context led to the abstraction of models that could be used in any socioeconomic situation. Hence the contextual cross-case analysis was made in this manner.

General Selective Coding: This process was not different from the process in the second stage. However the line of thought deviated from the contextual lines of this report. This does not imply that the contextual outcomes did not have an influence in the abstraction process, rather it implies that question behind the abstraction was: From a theoretical point of view, what does these sets of data say about implementation of Broadband Infrastructure in rural areas. This point of departure was necessary to streamline the context of implementation here. Just as in the second stage, reflection has been on the contextual outcomes, not to identify the common features in both cases, but also to identify features that were not common among the two but had the plausibility of leading to implementation.

REFLECTION ON GROUNDED THEORY AS AN ANALYTICAL TOOL

The difference between the general Grounded Theory analysis and the analysis for process is that, the latter is used for analyzing data for properties and dimensions and the later used to analyze data for actions/interactions, tracing it overtime to know how these actions changed or otherwise overtime (Strauss & Corbin, 1998).

The question, the process analysis responds to “What is the process?” (Strauss & Corbin, 1998). Based on this fact, this analytical tool was used. It is important to note that Grounded Theory is not used in this research as a theory building tool, but as a methodology for data analytical tool. The outcome of the process was hypothetical models which are permitted with Grounded Theory (See (Glaser & Strauss, 1967)). Hence, by implication, Grounded Theory in this report was not a theoretical framework. The reason for not adopting it as a theoretical framework was because the numbers of primary cases were few. If about fifty or more cases for each context of the primary cases were considered, hopefully an attempt would have been made towards theorizing using Grounded Theory. The problem with theorizing with six cases is that the sample size would be too small to enhance validity and reliability of such a theory.

The essence of the data gathering and analysis using Grounded Theory was to retrace and understand processes that led to implementation of the bottom-up PPI/PPPs. Hence it was important to identify causal factors as well as the resulting actions triggered by the causal factors. Hence it was important to understand the relationships between categories. It is this quest to understand the relationship between categories that content analysis, thematic analysis, discourse analysis and conversation analysis were not used. These forms of analysis are similar to the Grounded Theory approach as they involve the micro analysis of data, however, they do not create relationships for emerging categories (Ormston, Spencer, Barnard, & Snape, 2013) (Cho & Lee, 2004). However, in the process of micro-analysis, an attempt is made to understand social reality via the transcribed interviews and documents via coding (content analysis) (Cho & Lee, 2004). The understanding processes were aimed at actions/interactions. However, for the causal factors, the understandings were aimed at identifying themes (concepts) indicating actions/interactions or causal factors. These were the explicit ways of analyzing data in the grounded theory process. If this research were to be conducted again, Grounded Theory will be adopted still for the reasons mentioned in this paragraph.

Aside, the explicit micro-analytic processes, there were also implicit elements of micro analytic processes enabled by hermeneutics and semiotics. It is important to note that these qualitative analysis tools were not combined with the grounded theory process. They are mentioned as a result of the reflection on the process. However, in the interpretation of text and speech during the interview transcription and during the coding process to derive meaning or understanding of the coded text and speech, that was a form of hermeneutics (Bernstein, 2011). Hermeneutics is believed to deepen understanding of lessons learnt in understanding reality (Bernstein, 2011). Phenomenology was not used because the phenomena were neither investigated, nor described from the conscious experience point of view (essence or the basic nature of reality), devoid of causal factors (See (Merleau-Ponty, 1996)). There was nothing like, what “am I experiencing here” or “what does this phenomena mean to me?” neither was there an attempt to study the state of consciousness of the social actors. Rather, it was all about, what did they do? Why did they do it and what were the results?

6.5 QUALITATIVE VALIDITY ASSESSMENT

Creswell (2009) argues that validity and reliability in Qualitative research are different from validity and reliability in quantitative research. Qualitative validity implies that the researcher ensures the accuracy of the findings by using certain procedures (Creswell , 2009). While Quantitative validity implies that there is an assurance that the identified independent variables produced the dependent variables and not some other factor (Creswell , 2009). To ensure validity the certain procedures inspired by Creswell (2009) were ensured: This included triangulation, peer debriefing, the use of detailed description and dealing with bias.

TRIANGULATION

Methodology triangulation and theory triangulation, was one way data and analytical validity was ensured. The primary case study was a small study compared to the secondary case study. Hence there was no need for methodology and theoretical triangulation in the primary case. However, both forms of triangulation were used in the study of the secondary - cases.

Theoretical Triangulation: The theoretical triangulation involved the simultaneous use of the Grounded Theory and the ANT. The Grounded Theory, although used for different aims, did provide a confirmation to the core data gathered on how the secondary cases were organized and financed. One would say that the Grounded theory process provided more insight and that the same pool of data was utilized in both approaches. However, both provided similar retrospective perspective on how the secondary cases came to be and how the organization and funding arrangements were facilitated.

Methodological Triangulation: The Methodological triangulation involved the combination of the exploratory research and case study research. Both the case study and the exploratory research shared the inductive approach in common - hence intertwined. Although both modes of research were intertwined as the exploratory research was facilitated by the inductive method, and the case study was facilitated by the inductive and deductive method, both facilitated the use of multiple data gathering techniques for each case. Hence the source of evidence was not one data source, but different data sources which seemed to confirm the findings and themes in the previous sources of evidence. Aside, field documents, secondary data sources played a huge role here in validating evidence.

PEER DEBRIEFING

Sections of the report findings were presented at ICT conferences in Ghana to allow others ask questions about the qualitative study. This research was also presented at the CMI in house seminar. The essence of this process as explained by Creswell (2009) is to test whether others can in your presentation trace the events the same way you do.

BIAS

In discussing the axiology of this research, the bias in this research is mentioned in section 6.1.5

THE USE OF DETAILED DESCRIPTION

In relaying and explaining the findings and data analysis, detailed description of the cases and the circumstances surrounding the findings was adopted. This is aimed at making the findings realistic and valid.

Other actions recommended by Creswell (2009) which would have raised the validity would have been to have an external auditor who is not connected to the project to read and evaluate the process. The researcher is not sure if membership checking would have worked well. This is because those interviewed were more interested in telling their story than reflect on thematic discussions.

6.6 RELIABILITY ASSESSMENT

Qualitative reliability implies that the researchers, approach is consistent with different researchers and different projects (Creswell , 2009). Quantitative reliability implies that a replication of the study will produce the same outcome (Yin, 2009). To ensure reliability, the following activities as inspired by Creswell (2009) took place.

Reliability of transcripts: During the interview sessions, field notes were also drafted to supplement the audio response. When transcribing, these notes did help. However, the field notes did not contain word for word response. Hence in the process of transcription, to avoid errors, a piece of sentence was listened to twice. This was cumbersome. At the end of the transcription, the tape would be replayed while the researcher inspects the transcription.

Reliability of documents: Most secondary data used for this research came in the form of documents. These include documents from the field respondents as well as documents from secondary sources like soft and hard documentations. The documents gathered from the field sources were regarded as authentic. One would say that the respondents would have given documents that make them look good. However, the researcher's interest was on how the implementation occurred, how the group was formed, organized and financed. As a result of this most of the documents were discarded. However, these field documents became a yardstick for external documents on the subject. However, documentation for literature review were mostly from reliable publishers, reputable reports from organizations such as the World Bank or reputable journals.

Reliability of Coding: In the coding process, codes with certain properties bore those properties throughout the process. In the case of a change in labelling of the code, the change was done all through to the foundation of the code in the interview.

6.7 ETHICAL CONSIDERATIONS

Earlier in this chapter, a bit on ethical issues was discussed.

Ethical issues in the research problem: The research problem is of benefit to rural dwellers and it is also for their benefit

Ethical issues in the questions and purpose: Letters were sent to the respondent by the research center introducing the researcher. The purpose of the research was clearly conveyed to them. Attached to the letter of introduction was an attachment describing the research in brief and what is expected from the respondents. There was no misrepresentation of facts or intentions. In some cases, sample questions were attached

Ethical issues in data collection: There were no consent forms given to the respondents. In the pursuit of this research, various interviews exchange of documentation as well as emails occurred. For the interviews conducted via telephone, they were not recorded, but the salient points were written down. The participants were made aware that the interviews were for a research. For face – to - face interviews via Skype, these were recorded and the participants were informed about the recording. If they wished to say anything they did not want recorded, they requested that the recorder be paused. Face to face interviews were recorded except for the very lengthy interview with John Kibuuka, where the salient points were written down. Permission was occurred from John to be cited in this report. This he agreed to. The same was the case for Dr Nungu from Tanzania.

In the interview process, the respondents were not forced to provide information, they wanted to keep confidential. In the case where the respondent decided to provide such information, the respondent was informed that, it could only be so if he or she decides to be cited anonymously.

Ethical issues in data analysis and interpretation: The words “anonymous” is used to protect anonymous identities in reporting the interview process. There was no invention of findings in the process.

Ethical issues in writing: The data were presented as it emerged after it was analyzed. There was no gender, sexual, racial, disability nor age bias when the findings were reported.

FINDINGS AND ANALYSIS SECTION

This section consists of 5 chapters. These are chapters 7, 8, 9 10 and 11. The chapters present findings and analysis of relevant data gathered from the process of exploring the problem as well as exploring the solution.

Chapter 7 presents findings made in the process of exploring the problem. This was necessary because the problem this research attempts to solve is an old problem. In order not to assume that the problem still exists, an on-site observation was by visiting Ghana and Nigeria in the early days of this research. A visit was also made to Jaribu and Kerege villages locates in the Eastern region of Tanzania in 2014.

In the summer of 2014, mobile and mobile signal patterns in Ghana, Nigeria and Africa as a whole was studied. The aim of this study was to ascertain if the problem still exists and the dimensions of the problem. A desktop research was also made to understand, how the problem is viewed in the academic community in recent times.

These findings are presented in chapter 7.

Chapter 8 and 9 present the Actor Network Theory analysis and Grounded Theory analysis, respectively, of data gathered in the primary case study. Chapter 10 presents the Staeholder Analysis of data gathered from the secondary case study.

Chapter 11 presents a synthesis of the findings from chapters 7, 8, 9 and 10. These findings are presented as it responds to the respective objectives of the study. At the end of this presentation, the PPI models for this thesis are produced from the synthesis of the findings as it fits into the objective of the study.

CHAPTER 7. THE PROBLEM

The general problem is that there is either low or non availability of Broadband infrastructure in many rural areas in sub-Saharan Africa and by extension some rural areas in the world. The general reason for this problem is that the network providers and Internet Service Providers do not see rural areas as commercially viable, hence they are unwilling to extend Broadband connectivity to these areas for fear of running at a loss in providing these services (See (Calandro & Moyo, 2010) (Ohemeng & Ofusu-Adarkwa, 2014)). The general problem is not different from the specific problem. However the dynamics of the problem differ from one sub-Saharan African country to the other. Mobile Broadband penetration in Africa is higher than that of the fixed Broadband (Gillwald & Calandro, 2014). Despite the higher penetration of mobile Broadband to Fixed-Broadband, still, as mentioned in the next section, the penetration of mobile Broadband in Africa is still low.

To provide specifics for the problem, an effort is made to see the problem from the broader context of sub-Saharan Africa. Then in order to understand the problem better an effort was made to acquire a map that indicates the level of mobile connectivity in Ghana and Nigeria. Rather than rely on the map alone, visits were made to the countries adopted as secondary cases, Ghana and Nigeria. Hence, in this section, the problem will be expressed from a practical point of view and also as viewed by the academia.

7.0 INTRODUCTION

From the academic point of view, it has also been accepted that Broadband and internet penetration in Africa is low (See (Kelly, 2014) (Asogwa, 2014) (Lanerolle, Gillwald, Stork, & Calandro, 2014)). The low penetration, fixed Broadband (especially) and the moderate penetration of mobile Broadband has been attributed to reasons not limited to regulations, price of service, technology availability and the cost of delivering the technology (which affects coverage and affordability) (See (Gillwald & Calandro, 2014) (Katz & Berry, 2014) (Ohemeng & Ofusu-Adarkwa, 2014)). Other reasons include, inadequate high-capacity backbone networks (Williams M. , 2005) (Avila, 2009) (Lawal & Chatwin, 2012). In Rwanda, for example Broadband services is available mainly in the nation's capital, Kigali (Nsengiyumva & Habumuremyi, 2009). In the areas where the infrastructure exists, high cost of bandwidth is one of the cost issues affecting the Operational Expenditure (OPEX) of the Broadband providers (Dwomoh-Tweneboah, 2008). In other cases it has been attributed to an incorrect policy action of direct state involvement in Broadband delivery, in this case the adoption of non-market reform policies (Sutherland , 2012) (Gillwald, 2007).

From the academic point of view, one would say that although the problem of low Broadband connectivity in Sub-Saharan Africa exists. The reasons for the existing problem is not necessarily across board in Africa as each African market has its own unique situations. The situations are based on the telecom regulatory policies and the market dynamics that exist in such countries.

7.1 OVERVIEW OF THE PROBLEM IN THE BROADER CONTEXT OF SUB-SAHARAN AFRICA

In modern times one cannot underestimate the capacity of Broadband as an e-economy enabler. The internet platform has provided an avenue for Broadband to be adopted as an infrastructure for the transport for high capacity bandwidth for Internet services. Hence today, e-commerce, e-education, e-governance and other e-economic possibilities can be delivered as services to people remotely in their homes, places of work and from any remote location. The ability to reach the remotest part of the world is now possible. Unfortunately, the universal coverage of ICTs in general and in sub-Saharan Africa is far from being achieved as a result of the high cost of deploying Broadband infrastructure in non-commercially viable areas. The reason for this dilemma, one would say stems from the fact that from the late 1980's till date, as a result of the liberalization of the telecommunications markets, the diffusion of telecom infrastructure has been facilitated by the private sector. The private sectors' motive for investment is not to achieve Universal Access and Service but to maximize profit. Hence, areas that are not commercially viable suffer from either the provision of poor quality of services or no service provision at all. This problem is also evident in the sub-Saharan African region.

7.1.1 OVERVIEW OF THE PROBLEM FROM STATISTICAL REPORTS

Sub-Saharan Africa is one of the regions of the world, lagging both in the connectivity to Mobile cellular telephony, Broadband subscriptions as well as an Internet subscription in general. These subscription levels were the lowest in the world as indicated by the ICT Facts and Figures of 2014 (ITU (a), 2014). The reason for these low penetration levels lie generally in the fact that there are a lot of smart subsidy zones and True Access Gap zones in Africa.

To verify the existence of True Access Gaps and smart subsidy zones, it was important to match the penetration levels of the population of Africa. A summary of the findings is presented in the table below. Sub-Saharan Africa's population in 2013 was estimated at 1.1 Billion, out of which 926 million live in sub-Saharan Africa (PRB, 2013). Data from the World Bank indicates that 37% of sub-Saharan Africans live in urban areas (WorldBank, 2012).

Table 7- 1 Mobile and Broadband Telecom Service Penetration in Africa

	Service subscribed to	Percentage of subscription
1	Mobile Subscription in Africa per 100 inhabitants	69%,
2	Fixed Broadband Subscribers in Africa per 100 inhabitants	0.4%,
3	Mobile Broadband subscribers per 100 inhabitant in Africa	19%
4	Internet users in Africa	19%

Source (ITU (a), 2014)

This implies that approximately 343 million sub-Saharan Africans live in urban areas and about 584 million Sub-Saharan Africans live in rural areas. The logical matching process resulted in the following implications:

Internet Penetration: Logically, if 19% of the population uses the internet, it implies that there is an Internet Access Gap in the urban areas which accounts for 37% of the population of sub-Saharan Africa, not to mention the rural areas with 63% of the population.

Mobile Broadband Penetration: The same implication for Internet penetration holds for mobile Broadband penetration. This is because the penetration level of Internet Usage and mobile Broadband usage is 19%.

Fixed Broadband Penetration: The urban penetration of Fixed Broadband adoption in sub-Saharan Africa is quite negligible at 0.4%. Hence there is a huge market gap in fixed Broadband Service.

Mobile Telephony Subscription: 69% mobile cellular coverage implies that the 37% of urban dwellers in sub-Saharan Africa have access to mobile telephony while 32% of the rural dwellers in sub-Saharan have access to mobile telephony. One would say that mobile cellular telephony has saturated the urban areas and has penetrated almost 50% of the rural area. One would still say that 31 % of rural dwellers in sub-Saharan Africa is without subscription. That would be 341 million people.

Based on the matching of the levels of penetration of the communication technologies and the population of sub-Saharan Africa, one would say that the facilitation of Broadband infrastructure markets in urban areas in the various sub-Saharan African countries has not-been fairly successful. By implication, rural adoption of Broadband Infrastructure is low. However, these scenarios differ from country to country. Hence it was important to carry out some investigation on the level of communication facilities penetration in the Secondary cases.

7.1.2 OVERVIEW OF THE PROBLEM FROM TELECOM NETWORK COVERAGE MAPS

The map below was extracted from the signal monitoring website, Open Signal (Open signal, 2014). This website was suggested by from a source working with MTN Ghana, when a request was made for the Broadband coverage map of Ghana. The maps below indicate signals gathered from users of Android and iPhone applications gathered by Open Signal. The signals are represented in the form of rings. The reddish and yellow rings indicate areas with strong signals. The green rings are areas with moderate signals and the blue ring indicates areas with weak signals.

MOBILE CELLULAR COVERAGE

The first sets of maps indicate the level of 2g signals in different parts of Africa

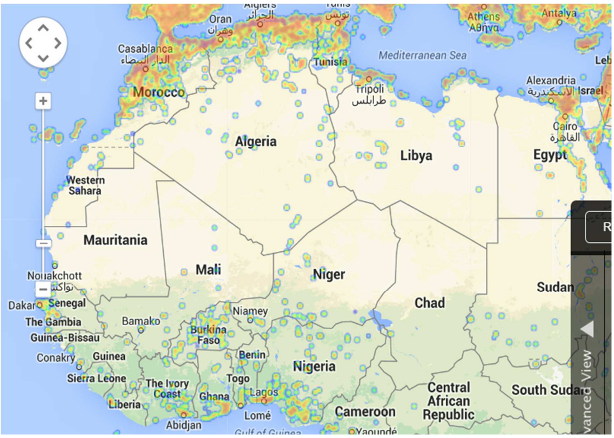


Figure 7- 1 2G Mobile coverage of West and North Africa

Source: www.opensignal.com

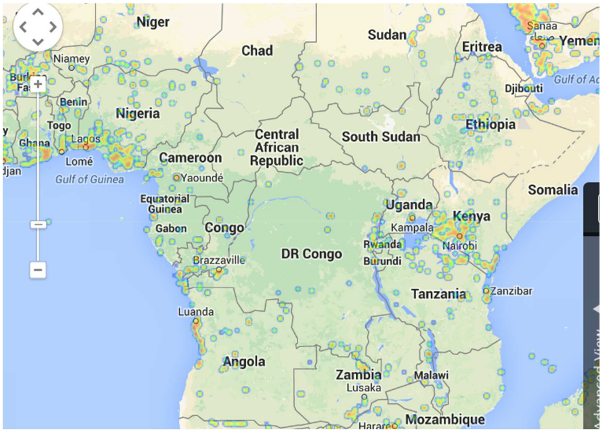


Figure 7- 2 2G Coverage map of East and Central Africa
Source: www.opensignal.com

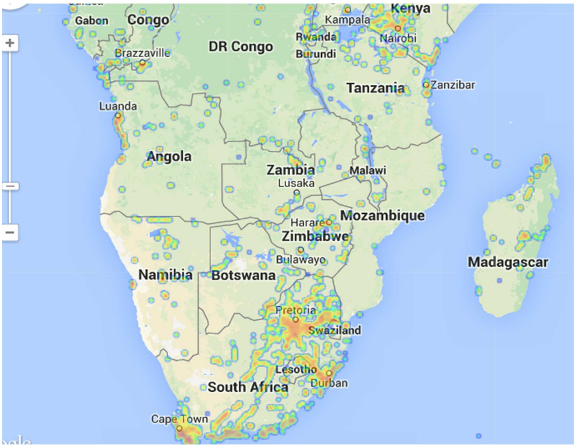


Figure 7- 3 ***2G Coverage map of South African countries***
Source: www.opensignal.com

The first three maps portray the level of penetration of 2G in Africa as a whole and sub-Saharan Africa as a subset of Africa. There is a dense connectivity of 2G GSM mobile cellular service in the western part of Africa, the Southern and Eastern part of Africa. This is because these are areas with population densities in Africa. In North Africa, the big cities are lined along the Mediterranean as well as the Nile in the case of Egypt. Hence, one can see dense 2G connectivity in these areas. However, one can also realize that the red rings (signals) are also dense in a few areas and are surrounded by the green and blue rings. This implies that the 2G signals are stronger in the cities, provinces and state capitals and are degraded as the deployment of mobile infrastructure extends to sub-urban areas and possibly rural areas. For example, Nigeria has more cities than the other West African States and the cities are concentrated in the western part of the nation and in the south with lesser number of cities in the north. These cities are commercially viable areas. Hence, one could see from the map, the level of 2G signal concentration. The same can be said of South Africa in the Southern part of Africa and Kenya in the Eastern part of Africa. One can also see from the maps that there are few areas where there are no 2G signals. Most of sub-Saharan Africa is uninhabited. However, one would say that the ITU statistics is plausible and there is a small access gap in the delivery of mobile telephony.

MOBILE BROADBAND COVERAGE

The second sets of map portray the level of 3G and 4G connectivity in sub-Saharan Africa.

Figure 7- 4 ***3G Coverage of West and North Africa***
Source: www.opensignal.com

Figure 7- 5 ***3G coverage of East and Central Africa***
Source: www.opensignal.com

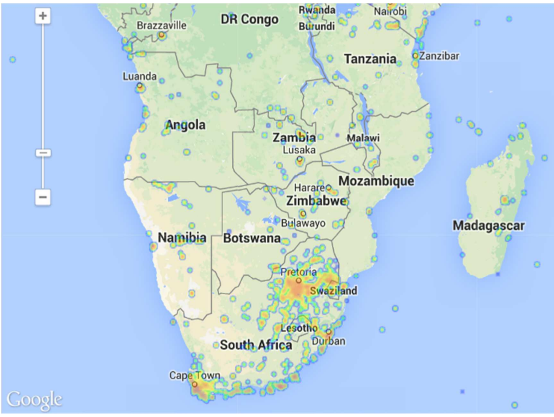


Figure 7- 6 ***3G Coverage of the Southern African Region***
Source: www.opensignal.com

The second set of maps portrays the extent of 3G coverage in Africa. If one were to juxtapose the maps with the corresponding 2G coverage maps, one would realize that the concentration of mobile connectivity is denser in the 2G coverage maps than in the 3G coverage maps. The similarity between both maps is that the mobile network operators have chosen to provide better signal quality in the cities. This can be seen in the case of Nigeria, Kenya, and the republic of South Africa and even in the Northern African countries of Morocco, Tunisia and Egypt. However, aside DR Congo, South Sudan and T'Chad, the mobile network operators in the other countries have made the attempt to sparsely dot weak 3G and rare strong 3G signals at strategic points in the other African countries. However, there seems to be a disruption as most operators have had to return to the cities to beef up their networks are 4G is gradually making its way into the African market. The advantage the mobile operators had with 2G was that they had from the late 1990s and the early part of the new century till approximately 2007 to deploy their networks. Between 2007 and 2010, they were forced to roll out 3G networks as the new mobile telephone networks preferred rolling out 3G. From 2010, mobile network operators in Africa have been testing 4G networks and in recent times, 4G licenses are being administered to a new market entrant. Now with the entrance of 4G into the market and regulators ready to roll out more 4G licenses, the maps below show the current state of the 4G coverage in Africa. Some countries have awarded 4G licenses to network operators and ISPs. A few examples are Airtel, which has been awarded a 4g license in Tchad (Airtel, 2014). Gabon Telecoms is also providing 4G via Gabon Telecoms (Gabon Telecoms, 2014). Etisalat has also been awarded 4G licenses at the Republic of Benin (Zyl, 2014). In Nigeria Smile communications are a few Internet service providers provided with license to deliver 4G (Smile Nigeria, 2014). This shift in the supply of mobile telephony is happening at a point where there is an Access Gap for 2G and a huge access Gap for mobile Broadband network for 3G. Unfortunately Broadband Wireless Access Networks like WiMAX is yet to compete with the existing GSM/UMTS networks. This is a problem for the underserved areas. These few examples will not feature in the maps below as they are small operations at the moment

Figure 7- 7 ***Mobile 4G coverage in West and North Africa***
Source: www.opensignal.com

Figure 7- 8 ***4G Mobile Coverage in East and Central Africa***
Source: www.opensignal.com

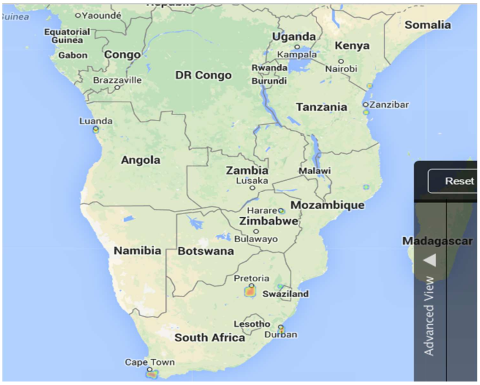


Figure 7- 9 ***4G Mobile Coverage of Southern African region***
Source: www.opensignal.com

The maps points to isolated 4G signals being available in Kenya, Gabon, Tanzania, Angola, and Republic of South Africa. These maps, in addition to the 3G coverage maps, portray the low penetration of Mobile Broadband in sub-Saharan Africa.

7.2 OVERVIEW OF THE PROBLEM IN NIGERIA

The quest to identify the problem took place in two forms. One was a visit to the case Nigeria as well as accessing the mobile cellular and mobile Broadband coverage in Nigeria. Unfortunately, attempts to get a fixed Broadband map were not possible. However fixed Broadband penetration of Broadband in Nigeria in 2013 per 100 inhabitants was 0% (ITU Broadband Commission, 2014)

7.2.1 PROBLEM AS IDENTIFIED FROM TELECOM NETWORK COVERAGE MAPS

MOBILE CELLULAR COVERAGE IN NIGERIA

The coverage of 2G signal in Nigeria as seen from the map is saturated in the Southern part of the country, but there are some spaces in the North. From experience on the trip to these areas, it was realized that Nigeria has a large landscape in the North that is not inhabited. Communities are separated as far 10 kilometers or more apart. However, in these areas, especially on the road from the South-South part of Cross River state through Benue State towards the North, there are few isolated poor communities. In these areas, mobile communication is poor as seen in the on the right hand side of the map. One will also realize that on the left hand side of the map there are communities beyond Ilorin on the land route from Abuja to Lagos, where there are also communities with poor 2G signals.

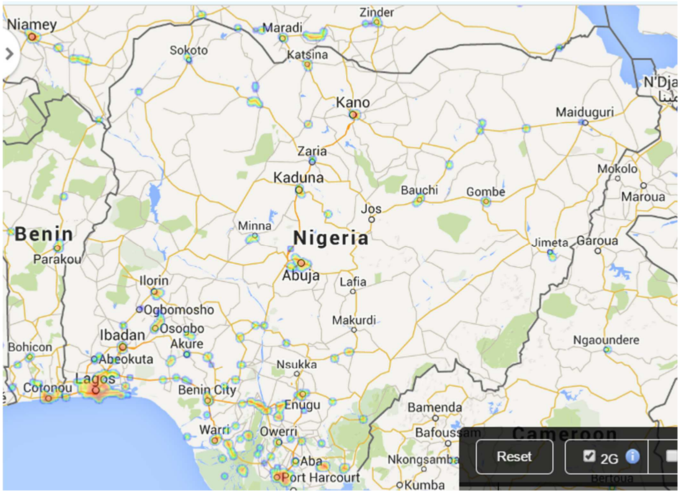


Figure 7- 10 2G Mobile coverage in Nigeria

Source: www.opensignal.com

However, GSM connectivity is prevalent in the cities, and state capitals. In the South the signal is stronger as these areas are more commercially viable than the North due to some of the states being either industrial states or oil producing states. In the North, every state capital as seen from the map record strong 2G signals. The signals in the other areas are mostly weak. Despite these setbacks, mobile cellular network distribution in Nigeria is vast. Mobile cellular subscription, in Nigeria is recorded by the NCC, the Nigerian telecom regulator, to by 91% in 2014 (NCC, 2014). Just as in the case of Ghana, Most Nigerians do own more than one mobile telephone, hence it is not clear if the statistic reflects one man one telephone.

MOBILE BROADBAND COVERAGE IN NIGERIA

The distribution of mobile Broadband infrastructure in Nigeria by the 9 mobile network operators has been across the lines of cities and state capitals. These are the places one can see the strong 3G signals. However, as a country with a large landmass and few cities in the states, one can see that those cities do not have strong 3G signals or no 3G at all. However, there is a concentration of 3G in the state capitals of the Niger Delta region, where the oil producing states are located. Rivers State and Delta state do have more concentration of 3G as indicated on the map with their state capitals Port Harcourt and Warri. There is also a huge 3G concentration in the commercial capital of the nation, Lagos and the Old city of Ibadan, which was once touted as the largest city in West Africa.

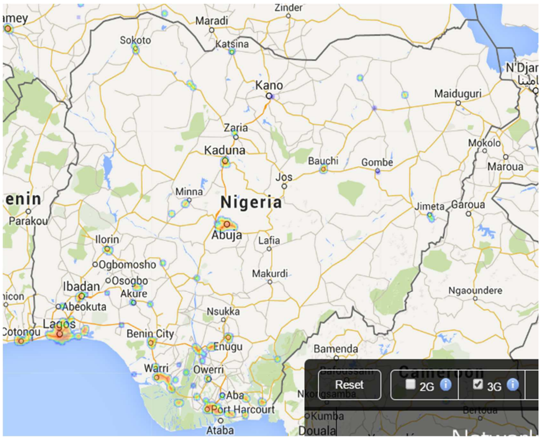


Figure 7- 11 3G Mobile coverage in Nigeria

Source: www.opensignal.com

In the East, as the commercial nerve center of the East, One can see some strong signals at Enugu, Owerri and Aba. The next area with strong 3G signal is at Abuja, the nation's capital Kaduna and Kano, the commercial nerve centers of the North. Aside these areas, the moderate and weak 3G signals are sparsely located in the country. In these areas 2G signals are more prevalent with little or no 3G signal.

Despite this development, the problem lays on the fact that Nigeria is a very populous nation with the majority of the poor living in rural areas. These are not commercially viable areas. The population served with 3G is nothing compared to the population not served with 3G. Data from the ITU corroborates this fact, as mobile Broadband subscription per 100 inhabitants was 10.1% (ITU Broadband Commission, 2014).

7.2.2 PROBLEM AS OBSERVED FROM ON-STIE VISITS

The Federal Republic of Nigeria is an entity with 36 independent states. Each independent state is made up of both urban and rural areas. A land travel between Lagos state in the extreme West and Cross River state in the extreme South Eastern part of the country revealed the presence of 3G mobile networks as one would pass by cities and state capitals. In the rural areas, one will experience the presence of 2G networks and in many cases no mobile network signals. One must concede that in most of those areas where there were no network signals they were vast woodland with very insignificant human population. On another trip between Akwa Ibom State in the South-South part of the country, and Nasarawa State in the middle belt of Nigeria, the same trend is realized. One would say that mobile penetration in Nigeria is high. The next thing was to find out if Broadband Internet had the same trend. There were two ways of finding this out. The first way was to visit internet cafes to test the data rates delivered. Unfortunately, at that moment in 2011, mobile Broadband was relatively new in Nigeria as GLO mobile was on the verge of introducing the 3G mobile technology. However, Internet Service Providers like IPNX, Starcomms etc. (now a network operator) were providing Broadband (fixed wireless Broadband) to their customers in Lagos and very few states in Nigeria. Attempts at getting access to high Speed Internet was mainly via VSAT terminals in other parts of the country. During the visit to a few internet café in Lagos, Akwa Ibom State, Cross River State and Nasarawa state indicated the presence of 256kbps delivered by very few Internet cafes. In some cases the data rates fluctuated.

One major problem identified was that although some states had Broadband Internet infrastructure, there was Broadband internet infrastructure deficient. The infrastructure and services were delivered to upper class areas of the cities in the states. In these areas the inhabitants could afford the service and they had use of it for their businesses and daily lives.

7.3 OVERVIEW OF THE PROBLEM IN GHANA

The same approach adopted in identifying the problem in Nigeria was also adopted in Ghana as well. Fixed Broadband penetration in Ghana in 2014 per 100 inhabitants was 0.3% (ITU Broadband Commission, 2014).

7.3.1 PROBLEM AS IDENTIFIED FROM TELECOM NETWORK COVERAGE MAPS

MOBILE CELLULAR CONNECTIVITY

The map below may be small, but one can see the areas with strong GSM (2G) signals and areas with moderate or low signals. Also, it is also glaring the level of mobile cellular connectivity in the southern part of the country is much more concentrated than the level of connectivity in the Northern part of Ghana. These are aggregated signals from the 6 mobile network operators in Ghana.

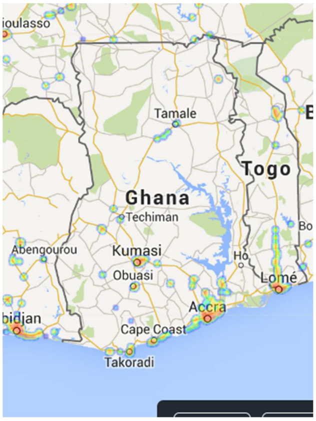


Figure 7- 12 ***2G Mobile coverage in Ghana***

Source: www.opensignal.com

The second feature one can identify is that the 2G signals are strong in Accra, the city capital, Kumasi, the populous and a commercial nerve center in Ghana, regional capitals such as Cape Coast, Takoradi, Tamale, Sunyani, Yendi and important towns such as Obuasi (The home of Ashanti Gold company) and few other important towns such as Nkwantia and Techiman as well as district capitals. Aside these towns, the signal strength ranges from moderate to weak. In some of the areas with weak signals, people subscribe to more than one mobile network as a means of staying connected. Statistics published by the NCA, the national regulator indicates that mobile cellular subscription, in Ghana is above 100% (NCA, 2013). This is plausible, as the level of 2G network coverage in Ghana is quite high.

MOBILE BROADBAND CONNECTIVITY

This is where one can see a clear problem. The map below had to screen printed with greater zooming to locate the areas with 3G signals in Ghana. There was no need to zoom the 2G map at the level of signal concentration could be seen without the zoom. It is also an aggregated signal map.

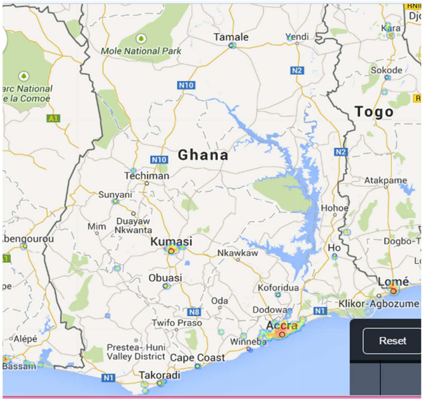


Figure 7- 13 3G Mobile coverage in Ghana

Source: www.opensignal.com

Here one can see that the emphasis for the deployment of network capacity were the important commercial nerve centers in Ghana. There is a strong 3G signal in Accra, and central Kumasi. Sunyani, Techiman and Cape Coast record very strong signals in the small cosmopolitan area and a weaker signal in the sub-urban areas. From personal experience in these outskirts, the network fluctuates between 2G and 3G signals. The plausible reason for Takoradi's experience could be as a result of the recent commercial oil production in the region. Prestea as one could see from the map is a close beneficiary of 3G services. However, if one takes a close look at the map, it is glaring that, aside the commercially viable areas, weak 3G signals are provided to some district headquarters, leaving the other vast areas to 2G connectivity.

As a result of the aforementioned problem, mobile Broadband penetration is quite low in Ghana. If there is no 5G, maybe the mad rush for 4G would lead to the closure of the access gap. There is no guarantee that such an event could occur. In Ghana the penetration of mobile Broadband per 100 inhabitants was 39.3% (ITU Broadband Commission, 2014).

7.3.2 PROBLEM AS OBSERVED FROM ON-STIE VISITS

In Ghana the same approach of travelling by night bus through a portion of the length and breadth of the country was not adopted. This was due to lack of resources for a round trip. However, a trip was made from Accra to Aflao as well as from Accra to Ho. Both Aflao and Ho are in the Volta Region of Ghana. Here most of the areas in the Volta region had two G connectivity, but the district headquarters, did record brief 3G signals.

The second approach was to partner with co-researchers to understand the problem. The partner was Patrick Gyaase Ph.D., and Associate Prof Morten Falch, as he (Patrick) was part of the same research group. Patrick was incidentally working on his research to study the e-readiness of Ghana for the purpose of e-government. The results were presented at the International Telecommunication Society (ITS) 2012 (Williams, Gyaase, & Falch, 2012). The focal point between that research and this research was to understand what would make ISPs extend internet connectivity to rural areas in Ghana. Ghana is a republic with 10 regions. The observations were made in Greater Accra (the nation's capital), Brong Ahafo region and Kumasi. Here it was realized there was in the city centers, there were internet cafes and Internet Service providers. But in the rural areas of these regions, the infrastructure and services for the internet were lacking. However, there was some form of mobile network connectivity in most of the rural areas except few. In this report, 25 Internet Service Providers among them were ISPs who owned Internet cafes were interviewed and 5 network providers were interviewed as well. None of the Internet Service Providers provided the service to rural areas because they saw no demand for the service in these areas and above all there was not internet infrastructure they could connect to. This implies that they would have to invest heavily to extend connectivity from the last access point to the rural area, which may be many kilometers away. In order to verify if it was true that there was no internet connectivity in most rural areas, the major network providers in Ghana were contacted. The mobile network operators were MTN Ghana, Vodafone Ghana, Expresso, GLO Ghana and Millicom (Tigo). This was a mixed method research. Data was gathered from a combination of face-to-face interviews and questionnaires. Data was analyzed quantitatively using Microsoft Excel. Here 3 of the network providers did assert that they do provide mobile internet access to some rural areas but it was on a low scale. But none provided Mobile Broadband Internet access in these rural areas. Their reason for not providing mobile Broadband infrastructure in rural areas in Ghana, was that the cost of delivering such a service will be very high.

Based on this fact finding mission, it is clear that there existed areas in Ghana and Nigeria, who, despite the over 100% and 87% respectively of mobile cellular penetration, that have little or no access to the Internet not to mention Broadband Internet. It is also glaring that there is a Broadband Internet Infrastructure deficit in these countries. This is not to say that there are no efforts to develop Broadband Internet infrastructure in these countries. In this report under the specific cases mention is made of these efforts. However, it is to say that there are still areas that are smart subsidy zones, which has to be located and of course, mobile cellular infrastructure is not present in every rural community in these countries. This is an indication that there are true access gaps. Hence, in the development of Broadband Internet infrastructure, these true access gaps have to be dealt with. It is important to note here that the public sector, has more interest in attaining Universal Access and Service of Broadband Internet than the private sector, hence the need for PPIs. It is impossible to attain Universal Access, once these zones are not reached.

CHAPTER 8. DESCRIPTION OF THE PRIMARY CASES USING ANT – RESULT AND ANALYSIS

8.0 THE PRIMARY CASES

The cases in the primary case study represented at least one case per continent. The cases were separated into three sub-groups. The developing country cases, the developed country cases and the public sector case. The developed country cases were the Djurslandsnet (Denmark), Hallaryd Broadband Coop (Sweden), and Magnolia Road Internet Coop (USA). The developing country cases where the Johannesburg Wireless User Group (South Africa), Dharamsala Wireless Network (India) and the Wireless Ghana Project (Ghana). The public sector Group (developed country case 2) is related to the Swedish case. This is the Almhult Municipality Broadband Initiative (Sweden).

The cases had to be different so as to present different perspectives from different rural continental scenarios. The South American cases could not be mentioned here as there was difficulty getting through to the rural people as a result of the language barrier. Several attempts to reach them proved futile; hence this research is robbed of the valuable experience that would have emanated from there. There was an attempt to get an interpreter, but there was a loss of contact with the interpreter. The South African case is not rural; however, it is a successful attempt by Africans to develop Community Based Broadband networks. Secondly, and most importantly, they made attempts to facilitate the supply of their services in rural areas but failed. This attempt provides a valuable lesson for this research.

8.0.1 RATIONALE FOR THE PRIMARY CASES

The rationale for choosing the primary cases was as follows:

These cases are all bottom up approaches: The cases are either civil society initiated infrastructure development initiatives or individually initiated infrastructure development initiatives.

The approaches are from developed and developing country perspectives: But the cases do not necessarily represent the developed and developing world in minute details. This is because rural areas differ in both individual developed and developing country contexts. Individual countries also differ in their sociocultural situations, socioeconomic situations as well as in demographics as well as geography. Based on these facts, rural areas differ. However, one would say that the fact that these cases exist, imply that attaining Universal Access and Service for Broadband Internet is important for both developed and the developing world - as the basic need to communicate in whatever form can serve as a catalyst for change.

Although the cases do not provide blanket representation for the adoption of the bottom - up approaches, it provides an insight to how the implicit desire to communicate could lead to change. The components of the implicit desire are possible lighthouses that one would say may be needed to facilitate bottom-up approaches in the development of Broadband infrastructure elsewhere.

They are rural based cases: Apart from the case of JAWUG of South Africa, the other cases are all rural based cases. Some of primary cases adopted in this research were not necessarily PPIs. However, they are mentioned because attempts to get the public sector involved failed. The failed attempt did not hamper the development of the Broadband internet infrastructure. However the failure of the public sector to come on board entails the possibility of PPIs from the bottom-up approach, not always been feasible, hence worthy of investigation.

The Rationale for choosing Djurslandsnet: The rationale for the choosing DjusrlandsNet was because their Wi-Fi Broadband network was built by volunteer groups in Djursland who trained themselves and mobilized themselves to build the network. They also had some public aid along the way. It was interesting to see how this PPI came to be.

The rationale for choosing Magnolia Road Internet Coop: The Magnolia road Internet coop in Colorado, USA, was chosen because it was similar to the Djurslands case. But it had a twist in the fact that it began with one man who toyed with the idea of connecting his friend’s house with wifi and the process grew to become a network whose signal covers much of Colorado for the rural area providing Broadband. On the flip side, this was meant to be a PPI but it did not happen that way. What happened and what lessons could be learnt from this case.

The rationale for choosing JAWUG: The case of JAWUG in South Africa was an interesting one, there was no PPI here. However, what was interesting in the interview here was the failed attempts to extend the Broadband network to rural areas in Johannesburg. This case was the first eye opener to what might happen to the proposal of this research and forced a rethink, especially after the interview with John Kibuuka. The food for thought here gives room for a PPI.

The rationale for choosing Dharamsala network (India): The Dharamshala wireless network, owned by Airjaldi, is the largest Wifi network in the world. The coverage of the network extends to the underserved and rural people of India as well. It is a social enterprise that began with few foreign facilitators. This is not a PPI but it gives room for PPIs when one puts it side by side with the possibility of extending this service in rural sub-Saharan Africa.

The Rationale for choosing Almhult municipality Broadband Initiative: This case is a PPP involving the Almhut municipality in Sweden and 9 Broadband coops. The point of departure in this case is that they are deploying fixed Broadband (FTTH) solution to their parishes. The arrangement of this PPP was also inspirational and provided food for thought for the primary- cases. The municipality involvement is treated separately from the Coop involvement in this thesis. The aim of this separation was to decouple the hybrid approach and analyze the municipality top-down approach separately from the coops' bottom up approach. The nature by which the PPP was organized provided this possibility to decouple the analysis. Secondly, some of the Broadband coops existed before the municipality initiative was conceived. Thirdly, the municipality approach provided inspiration towards public involvement in such an arrangement. It is only in the ANT analysis that there is a merged analysis. This was done to avoid repetition in the ANT analysis of the process. When adopting the Grounded Theory analysis, the municipality and Coops implementation processes are viewed from their independent standpoint.

The rationale for choosing Hallaryd Broadband Coop: Hallaryd was the only co-op that gave a positive feedback on the request to be interviewed for this research. However, studying the coop and gathering information about the other coops from the Munpality officer, led in understanding how the coops responded and eventually became partners with the municipality. The second rationale was because the organization of the PPP gave the coops ownership over their fiber optic access network. Hence, they had a great deal of autonomy in mobilizing themselves, choosing the best financial arrangement for their sustenance and they were independent.

In this research there are 2 PPI cases, 1 failed PPI case, 2 African cases and 1 non-PPI case. From this perspective, we can identify the challenges as well as factors that lead to success in deploying PPIs in rural areas. There were attempts to get as many other cases, but these were the only cases that responded to the call to be interviewed for this research.

GIFEC, USPF and John Kibuuka did mention challenges in the delivery of ICTs in rural areas. This will be mentioned in the discussion segment. Adopting the ANT lets look at the cases one by one. The cases are divided into 2 parts. This includes the developing country cases and the developed country cases. In these established cases, one could study them to know how they are financed and organized. One can also learn about the PPI dynamics about it to aid as an inspiration for the PPI model.

8.0.2 RATIONALE FOR MAKING WIRELESS GHANA PROJECT A PRIMARY CASE

The Wireless Ghana Project started on a very promising note where non-Governmental organizations embarked on a rural Broadband initiative. Unfortunately, it could not be sustained. It is important to understand why, how it started, the strides it made and why it could not be sustained. This case provides a glimpse to possible bottom up approaches in Ghana and sub-Saharan Africa and enriches the discussion of this report as an attempt will be made to understand what lessons one could adapt from the primary-cases as well as lessons learnt from the case itself to help the Ghanaian and sub-Saharan African combat the Broadband infrastructure deficiency in rural areas.. The ANT is used to retrace the steps of the development of this network

8.1 DEVELOPED COUNTRY – CASES

The ANT is used as a descriptive and analytical tool to describe the Primary cases situated in the developed countries. In each case the story behind their implementation is described. The organization and financing arrangement of each case is described as well. In each case, the findings recorded include the specific telecom regulatory environment that affected the case, the demography of the rural areas, an overview of the case and the Actor Network Analysis. The demography of each case is described to present the socioeconomic context of the rural area being discussed.

8.1.1 MAGNOLIA ROAD INTERNET COOP, USA

As mentioned earlier in this report, there are lots of rural Broadband Initiatives in the United States. Each of them will definitely have unique stories. The case of Magnolia Road Internet Coop was identified via internet search. It was one of the first Broadband Coop to respond to the invitation for an interview. It was difficult was difficult to get across to many others. However, the contact with Mangolia Road did not happen until one day their Facebook link showed up in a search made for them on Google. A Facebook message was delivered and luckily there was a response from Greg Ching, one of the board members of the Coop. Communication with Greg was via email exchanges, where he responded to my questions as well as provided documentation and weblinks to where I could find some answers. One of the most important and insightful material sent to me by Greg was event timeline, a diary of events from the mental conception of the Magnolia Road Internet Coop to its actual implementation of the plans. Aaron Caplan, also a board member of the

Coop, was also of help, as he helped with the maps that showed the penetration of MRIC internet network in Colorado. In this section, the description will comprise of:

- Universal Access Regulation in USA
- Demographics of the rural area
- Overview of the case
- Actor Network Analysis

UNIVERSAL ACCESS REGULATION IN USA AND COLORADO STATE

In the United States, current telecom regulation exists both at the national level and the state level. The Federal Communications Commission (FCC) regulates telecommunication at the national level, while the independent state Public Utility Commissions (PUC) regulate telecommunications in line with other sectors of the state's economy. At the federal level, coordinated by the FCC, the telecom communications act of 1996 does not mention coops as network operators although there is room for rural network operators. However the Universal service definition in the ACT does include the delivery of telecom services to rural and high cost areas via initiatives such as the Federal Universal Service funds and link up America initiatives (Department of Regulatory Agencies, 2011).

In Colorado, there is coordination – just as other American states- between the FCC and the PUCs in facilitating the Universal Service via telecom infrastructure delivery. The coordination exists in the definition of who is local exchange carrier in order to receive funding. In Colorado, the state universality fund managed by the state PUC is the High Cost Support Mechanism (HCSM) initiative (Colorado.gov, 2014). The initiative was enacted in 1992 by the Colorado Senate with the aim of reimbursing basic local exchange provision in high cost areas (Department of Regulatory Agencies, 2011).

There is also coordination within the reduction of the cost of telephone subscription via the lifeline assistance program. The aim of the program was to enable reduced monthly rates and initial charges to rural and disabled subscribers (Department of Regulatory Agencies, 2011). This was a form of subsidy granted to Telecom operators operating in the rural area, via monthly access line fees. The conjunction lays on the fact that FCC provides the regulatory framework and financial subsidy, while the states PUCs establish the criteria of eligible individuals for the program, they can add on the subsidy and establish their own regulations and control of the program (Symanski, 2010).

DEMOGRAPHIC BACKGROUND OF THE RURAL AREA

Magnolia Road is a stretch of road located in the town of Nederland in the Boulder County in Colorado state in the United States. The 2012 demographic profile data from the US Census Bureau indicated that Nederland, Colorado is inhabited by 1445 citizens (US Census Bureau, 2010). The same source places an estimate for the town in 2013 to be 1491 citizens. 99% are educated; there are 753 households in the town. The median household income is 68071 per annum, 16.7% of the individuals live below poverty level and the Median Age is 39.9.

OVERVIEW OF THE CASE

The MRIC network is a wireless Broadband network facilitated by Wi-Fi. The Broadband internet bandwidth is purchased from an Internet Service Provider and redistributed through point-to-point and point to multi-point wireless networks. The network provides coverage to 20 024 citizens of Colorado (0.4% of Colorado citizens). They serve 9640 households. They offer download data rates of 3mbps – 6mbps and upload data rates of maximum 1.5Mbp. The information is extracted from appendix A 1.2.

In 1996, an ISP PeakNet opened free Internet kiosks in Nederland. This inspired Bill Clark in 1997 to start-up the Sugerloaf Internet Coop. His coop provided T1 speed (1.544 Mbit/s) to its members via low powered radio transceivers. Bill Clark's initiative in the SugarLoaf areas inspired his colleague living in the Mangnolia area. His name was George Watson. In 1999, George did set up his home wireless LAN.

The dream of attaining High Speed Internet became feverish in 2001, when the PPHCP held a meeting on providing High Speed Internet Access alternatives. Rob Savoy of the PPHCP's high speed internet project began discussing the prospects of starting a High-Speed Internet project in the Magnolia area with Greg Ching, a resident of Magnolia road. Rick Cobb, Allen Schmitt-Gordon and Paul Kolesnikoff were later invited to be part of the discussion. Rick, and George Watson were neighbors. Rick decided to contact George Watson to learn about the capabilities of the home network (Wireless LAN). The discussion led to George extending connectivity from his house to Rick's house to test the feasibility of WLAN. Successful connectivity led to 4 more houses being connected to test the feasibility of having more users.

These successful tests convinced Greg Ching, Allen Schmitt-Gordon and Rob Savoy that WLAN (802.11) had the potential of enabling remote internet connectivity. This led to the first task of identifying the first set of necessary actors. The founding members of MRIC had their first meeting and registered a domain name for the purpose of setting up a website. Discussions began with Bill Clark, the owner of Sugar loaf on how to hook up to his network Sugarloaf.net. There were the discussions with other T1 providers to gain access to both bandwidths as well as outsource backhaul connectivity.

Puma mailing list and Yahoo group were created as a means to sensitize neighbors about the possibility of owning a cheaper network. The Puma Pot lock was also an avenue where the founders met people to talk about their initiative.

Tim Plant, the state representative came on board and promised to secure the Colorado State Universality funds for the project. A lawyer, an insurance broker were hired to aid in the incorporation of the coop, while George Watson did volunteer to keep testing the range and Quality of Service of the network. The founders donated their houses for the tests, they donated their finances to buy the equipments and also did help in mobilizing people to sign up to the initiative. In one of the tests, George Watson was able to record 5Mbps ¼ miles away from the transmitting antenna. He was helped by a group of volunteers, which were mostly the founding members and a group of enthusiasts.

By the end of 2001, 44 would be subscribers had registered. The slow US economy led to a temporary freeze on universal funding possibilities from the State of Colorado. This led George Watson to re-customize Orinoco AP- 100 wireless cards into repeater station, wireless routers. This led to MRIC saving up to $300 USD per repeater station bought. The connectivity between Greg Ching and George Watson’s home, which was 0.9 miles away and the public demonstration of this feat, among other public demonstrations led to more members signing up. 39 trials were carried out before the first connectivity was carried out.

In order to raise finance to connect subscribers, the would-be subscribers provided a loan of $300 USD each to the coop. Each of them was given promissory notes. The first amount raised as seed capital resulted in $15000 USD. In June 2002, Don Roper became the first subscriber followed by the initial 22 subscribers. Fortis communications provided T1 connectivity and backhaul connectivity. In the same year, MRIC merged with Sugarloaf.net, as George Watson was the managing director of Sugarloaf.

Today MRIC is one the major Broadband Internet coops in Colorado, reaching 0.4% of the population of Colorado. The areas with strong signals as well as members are West of Boulder, Sugarloaf Mountain areas, Coal Creek Canyon, Nederlands ridge road and Boulder’s Lakeshore neighborhoods.

They were not able to attract state funding because the state only reimbursed projects that cost $100 000 USD and above. Their project was facilitated between $13000 USD and $15000 USD

ORGANIZATION AND FINANCING OF MAGNOLIA ROAD INTERNET COOPERATION

Organization arrangement: The MRIC is led by a 6 member board of directors, who occupy their office for a two year term. They are supported by members, who are subscribers of the network and volunteers who help in extending and maintaining the network.

Financial Arrangement: The MRIC is sustained by member contributions from membership fees and monthly subscriptions. The members pay US$50 one-time membership fee, US$50 dollars monthly internet account and access. They also charge US$25 reconnection fee for those who terminated their agreement and hope to be reconnected.

ANT ANALYSIS OF CASE

Adopting the Michael Callon Framework, the retracing of the actors and the events will be described with regards Problematization, Interresement, Enrollment, and Mobilization.

Problematization: The problematization stage is represented in the table below. In problematization was to understand why there is no High speed Internet Access in Magnolia. The human and non-human actors identified in the box below were identified as central actors that led to looking for solutions to the problem. There could be other names that are missing here.

Box 8- 1 Identified Actors in Magnolia Road Internet Coop

	Event	Actors	Actor Networks	Spokesperson
Problematization	The problematization was clearly why are we not getting high speed internet access in Magnolia?	**Human**: Rob Savoy, Greg Ching, Rick Cobb, Allen Schmitt-Gordon ,Paul Kolesnikoff, **Non-Human**: PPHCP, high Speed Internet, George Watson , WLAN (technology), Houses	- PPHCP members - George Watson/WLAN, -George Watson /WLAN/Rick Cobb - MRIC founders	-Rob Savoy - Connectivity - Connectivity - MRIC board
OPP	Coop needed to facilitate connectivity	**Human**: Rob Savoy, Greg Ching, Rick Cobb, Allen Schmitt-Gordon ,Paul Kolesnikoff, **Non-Human**: Volunteers, ideas, technology artefacts, institutional actors	MRIC	-Quality of Service

The inspiration to solve the problem came from two actor networks. The first actor network was the PPHCP members who were interested in facilitating the internet infrastructure. Their spokesperson was Rob Savoy. The second independent network was that of George Watson and his personal WLAN. The spokesperson here to the world, was the presence of connectivity. It was the evidence of connectivity that led Rick Cobb and his house to join the network to know connectivity will still exist. The positive affirmation of connectivity possibilities led the George Watson/WLAN actor network and the PPHCP members to merge into the MRIC founding father actor network.

As seen in the table, still in the process of problematization, an Obligatory passage point OPP is created on how to solve the problem. They had to create a coop with both human and non-human actors identified in the table below to form Magnolia Road Internet Coop. If they had to attract people to join the network, hence the Quality of Service, provided should encourage people to join the network.

Once this path is created, the next step is to designate responsibilities to the members of the network. This is the Interessement phase. However, in this case one would say that the previous actor networks now become actors in the MRIC network. This is referred to as punctualization and the MRIC network becomes and actor network of black boxes.

Interessement: The actor needed to facilitate the OPP were human, organizational and Nonhuman actors as seen in the table below.

Table 8- 1 Actors invited into the Actor Network

	Human Actors	**Organizational Actors**	**Non-human actors**
1	Volunteers	State regulator (PUC)	Technology artifacts
2	Board members	Sugarloaf	Ideas
3	State representative	Fortis communication	Connectivity
4	Lawyer	Peaknet	Quality of Service
5	Subscribers	Insurance broker	Money (funding)
6		Insurance company	Houses
7			Puma mail

	Verbal invitation
	Puma Pot luck

Williams (2015)

The human actors needed were:

- **Volunteers:** They would help in the infrastructure installation and management of the coop
- **Board members:** They would run the organization
- **State representative:** He helped to source for state funding
- **Lawyer:** he helped in the incorporation of the coop
- **Subscribers:** They would finance and subscribe to the high speed internet service.

The organizational actors were:

- **PUC:** the state regulator to finance the project
- **Sugarloaf:** An existing coop they could merge with
- **Fortis communication:** An Internet service provider that could provide bandwidth and also aid in backhaul management.
- **Insurance broker**: They would help to identify to search for an underwriter for the infrastructure.
- **Insurance company**: They would ensure the infrastructure against damages.

The Non-human actors were mostly actors that would be used to enroll the identified actors into the actor network. Their role is discussed under enrollment.

Enrollment: This is the process where negotiation occurs between the MRIC initiators and the identified actors to take accept their role in the actor network. Ideas were used to facilitate the development of the network and the invitation of would be the state representative, subscribers, volunteers and members. Ideas were mediators between the MRIC founders and their vision. The outcome of the effect of the ideas was multi-directional. Verbal Invitation, Puma mail, Yahoo Groups and Puma Pot luck were used as a means of reaching out to would – be subscribers. They were intermediary actors. Houses served as important actors for the tests to verify Quality of Service and connectivity. Quality of Service and connectivity of the service provided assurance to the would – be subscriber that there was value for money for the service. Money was an important mediator between the human actors and the facilitation of the network. Money was also an intermediary between the MRIC and the organizational actors save the PUC. The PUC could not be enrolled into the network as MRIC did not meet the requirements of the PUC.

Mobilization: This is the process where every actor is fulfilling the function assigned to them and the MRIC actor network was formed. The spokesperson for the network was the Quality of Service provided by the network.

IDENTIFIED PPI

The Magnolia Road Internet Coop, one would say, is a PPI for the same reasons as that of JAWUG and Airjaldi in section 8.2. The public sector provided indirect governance by deregulating Wi-Fi spectrum, while the non-profit private sector (the coop) designed, built and operated the network. The profit making private sector managed the backhaul. However the difference here is that this case was almost a Private DBO form of PPP, where the private entity would have received funding from the public sector to develop the Broadband infrastructure. However, this did not happen, not because the public sector was not willing to be a part of the project, but because the public sector had a spending threshold that would warrant their involvement. The spending threshold, on information gathered from Greg Ching in a follow up email, was US$100 000. However the total amount of money spent by MRIC on facilitating the infrastructure was US$13 000, hence they could not get the funding.

Hence, once one would say that the state funding from the State of Colorado in the US was available and the MRIC case was a potential PPP. However, as a PPI, the deregulation of the 802.11b Spectrum was the main public indirect contribution to the project.

8.1.2 DJURSLANDSNET DENMARK

Djursland is a Peninsular in the North Eastern part of Denmark on the Eastern Coast of the Jylland Region. This case was identified via snowballing with the help of Wolter Lemstra and Vic Hayes from Delft University. An 8 hour face to face interview (2 day) was conducted with Bjarke Nielsen and a former volunteer Stephen at Grenaa in Djursland. Visits were made to the sites and supplementary materials were gathered from DjurslandsNet. In this section, the description will comprise of:

- Universal Access Regulation in Denmark
- Demographics of the rural area
- Overview of the case
- Organization and Financing of the case
- Actor Network Analysis
- Identified PPI

UNIVERSAL ACCESS REGULATION IN DENMARK

The telecommunications market in Denmark was fully liberalized in 1996. As a result of the liberalization, by 1998, there were more than 50 participants in the Danish market with five major operators (OECD, 2000). These market participants were regulated by the defunct telecom regulatory agency, the National Telecom Agency (NTA) between 1991 and 2014. The agency's duty was to promote competition and facilitate consumer protection (OECD, 2000). Hence telecom infrastructure delivery from the public sector point of view was the prerogative of the private sector. Universal Access was facilitated by granting Universal Service Obligations to the incumbent operator. Although the duties of the NTA have been shared across the ministry, the Danish government does not interfere in the facilitation of telecom infrastructure delivery.

DEMOGRAPHIC BACKGROUND OF THE RURAL AREA

Land size: Djursland has a land size of 44km by 33km.

Administration: It was formerly the home of 8 municipalities until the 2007 municipality reforms in Denmark. The municipalities were Grenaa, Nørre Djurs, Rougsø, Sønderhald, Rosenholm, Rønde, MidtDjurs and Ebeltoft. From 2007 the municipalities were grouped into 2 municipalities namely the Norddjurs and Syddjurs municipalities. The Norddjurs municipality consists of Grenaa, Nørre Djurs, Rougsø, Sønderhald (part of it is in the Syddjurs municipality) and the Syddjurs municipality consists of the Rosenholm, Rønde, MidtDjurs and Ebeltoft.

Population: The total population of Djursland is 79510 with Norddjurs comprising of 37839 and Syddjurs comprising of 41671 citizens (Statistics Denmark, 2014).

Geography: The peninsula has a hilly topography with 3 main forests.

Economy: The areas such as Grenaa and Ebeltoft are small towns with light industries, and commercially viable. Rosenholm and some other towns are tourist attractions. In Rosenholm the first castle in Denmark is located there for example. There are fishing towns as well as agricultural areas. Aside a few parishes, Djursland by Danish standards is rural as you have very low population density in some of the parishes. Their income level varies as well. But one cannot say that it is low (Statistics Denmark, 2014).

Education: The education is also not low in these areas (Statistics Denmark, 2014).

DESCRIPTION OF THE CASE

DjurslandsNet was born out of a need just as in other cases. However, the difference here is that by the time this need existed in Djursland, many of the people in Djursland did not know they had that need. Secondly the technology (802.11) needed to solve the need was unknown and under development. The general problem that existed in Djursland then and still persists –though not as it used to be now- was that mobile coverage was very poor. Secondly, those with access to fixed line telephony were mostly in the semi urban areas such as Grenaa, Ebeltoft etc. In the rural areas such as Gjesing in the old Rougsø Municipality (Now in the Norddjurs Municipality) where very few people live. Today, about 322 people live in this area (Danmarks Statistik, 2014). In 2001, when DjurslandsNet was born, there might have been a less number of people living there. Other areas in Rougsø with less than 500 inhabitants include Holbaek, and Noerager. Other areas such as the old Sønderhald municipality (part of it is in Norddjurs and part of it is in Syddjurs) had areas such as Øster Alling, with 308 inhabitants today, that are rural areas (Danmarks Statistik, 2014). People living in these areas, including those not mentioned faced the problem of inadequate supply of telephony services.

Djurslandsnet and its evolved networks provide wireless Broadband infrastructure using Wi-Fi technology. The network(s) had 10000 connections provided by 500 Wi-Fi nodes. The number of connected households has increased since then. To ensure Quality of service, the each node served a maximum of 30 households. The gateway to the network is a regional fiber optic network.Back haul connectivity is extended using point-to-point antennas on the roof of every other two or three households throughout Djursland. Hills and vantage points are used to extend connectivity as far as Anholt. Omni directional antennas are used to serve the 30 households per cell. The network provides data rates of 12mbps to 16mbps downlink and 10mbps to 12 Mbps uplink.

The driving force towards the emergence of Djurslandsnet was a fine arts teacher named, Bjarke Nielsen. He was always fascinated by the advancement in Information Technology (IT). His initial interest with IT was to enable him to deliver more efficient artwork – as he was a trained art teacher. However, learning to repair personal computers by himself, led him to learning more about the potential of network cards and eventually wireless networks. His first encounter with wireless Networks occurred in the 1990's when he and a group of enthusiasts tried their hands on a long distance walkie talkie network. They used this network to download video games such as Northen commander and make long distance calls to Holland. About the same time, he was repairing computers for his neighbors and fellow citizens of Djursland leading them to start the computer problem solving workshop (Boevl), which occurred every month.

In the mid 1990s, Bjarke and his Boevl members received a municipality grant to facilitate fixed-line internet telecentres. The culmination of their experience from the walkie talkie network days, to the facilitation of the municipality project, led the group to realize that they had the competence to facilitate an efficient communications network. They were experiencing poor Quality of Service of the fixed and existing mobile technology.

However, their first step was to seek financial help from the municipality, the Danish Business Association in Djursland and the telecom infrastructure and service providers. In their bid to make their case with the external funding sources, Bjarke and his team were able to gather signatures of interest from 600 residents of Djursland. However, their inability to make a good business case led to their inability to attract the help from the Danish Business Authority and the telecom infrastructure and Service providers. The municipality could not help because in Denmark, policy towards telecom infrastructure delivery was a prerogative of the market.

Their initial idea was to facilitate fiber optic connectivity. However the idea was not clear on whether it should be the Fiber-To-The-Home (FTTH) or Fiber-to-the-cabinet. This idea was discarded as it was regarded as too expensive. Hence Bjarke and his group decided to go for facilitating wireless Broadband internet (802.11b). However – as mentioned earlier-, there was no clear business case for the Danish Business Authority and the telecom network operators. Hence, these organizations could not be enrolled into this course.

However, financial aid granted by the EU provided a financial lifeline of €500 000 (Euros) for the project. But the money was to be paid at the end of the project based on the invoice tendered. However, the inability of Bjarke and his team to attract initial funding led to a debriefing meeting for the six hundred signatures. It was at this point in 2001, that the six hundred signatories decided to develop the infrastructure by themselves based on the fact that they had the numbers. The Broadband cooperative was named Djurslandsnet.

ORGANIZATION AND FINANCIAL ARRANGEMENT OF DJURSLANDSNET

Organization of the case: DjurslandsNet was organized as a federated organization headed by a central board and supported by each sub-boards as seen in the box below. The chairman, Secretary and treasurer of each sub-board were members of the central board. The daily functions of each sub-board and the central Board at Grenaa were supported by a team of volunteers. Most of the volunteers were initially part of the Boevl group that also metamorphosed into Djurslandsnet. Other volunteers were eager members who were interested in facilitating connectivity to their then Municipality.

<table>
<tr><th colspan="3">Djurs Internet frammentazione egnsnet</th></tr>
<tr><td>2000></td><td>2005></td><td>2010></td></tr>
<tr><td rowspan="13">DjurslandS.net</td><td>EbeltoftS.net</td><td>EbeltoftS.net</td></tr>
<tr><td>GrenaaS.net</td><td>GrenaaS.net</td></tr>
<tr><td>MidtdjurslandS.net</td><td>MidtdjurslandS.net</td></tr>
<tr><td>Noerre-DjurS.net</td><td rowspan="2">Primanet</td></tr>
<tr><td>RougsoeS.net</td></tr>
<tr><td rowspan="2">RosenholmS.net</td><td>Rose Holm Net</td></tr>
<tr><td>Dark-river valley networks</td></tr>
<tr><td>SoenderhaldS.net</td><td>Vestdjursnet</td></tr>
<tr><td>RoendeS.net</td><td rowspan="2">The regional network</td></tr>
<tr><td rowspan="3">Egnsnet 9</td></tr>
<tr><td>FladstrupS.net</td></tr>
<tr><td>PederstrupS.net</td></tr>
<tr><td>FrilandS.net</td><td>FrilandS.net</td></tr>
</table>

Figure 8- 1 ***Structure of DjurslandsNet***

Source: http://djurslands.net/

Finance raised from the sub-boards were controlled by the central board. The disagreement on the use of the central finance to facilitate equipment and Broadband capacity upgrades led to the disintegration of Djurslandsnet. However the organization in 2005 disintegrated along the old municipality lines and sub-boards as seen in the box above. However, the new independent coops still maintained the Djurslandsnet business model.

Financing of DjurslandsNet: The subsidy from the EU did was a catalyst for developing the network. However the money was meant to be a reimbursement for the expenditure on facilitating the network. Hence, to facilitate connectivity, upfront one time payment of 1000 DKK for access and 1000 DKK monthly subscription earmarked for the members. The existence of six hundred initial members provided a possibility for an economy to initiate the facilitation of wireless Broadband network.

ANT ANALYSIS OF THE CASE

Adopting the Michael Callon Framework, the retracing of the actors and the events will be described with regards Problematization, Interresement, Enrollment, and Mobilization.

Problematization: The problematization stage is represented in the table below. The problematization was to find out how network connectivity can be achieved using wireless network solutions. In this case, unlike that of MRIC, the problematization was done by an individual – Bjarke Nielsen-and not a group. He also fashioned out the Obligatory Passage Point and identified the necessary actors needed to solve the problem. The human and non-human actors identified by Bjarke are represented in the table 8.2 below were identified as central actors that led to looking for solutions to the problem.

At this stage there was only one Actor Network, Bjarke and his interaction with wireless Broadband technological artifacts. He envisaged a Broadband organization, not necessarily a co-op. His initial idea as he mentioned in the interview was a Public Private Partnership, this was why he went to public and private sector organizations for help. However, he had a second plan. This was based on his experience with the boevl and the initial municipality project leading him to believe that people can facilitate these networks. This led him to start up a school to train people on how to make Broadband networks. Hence, identifying the actor network as Broadband coop is implied.

At this stage there was only one Actor Network, Bjarke and his interaction with wireless Broadband technological artifacts. He envisaged a Broadband organization, not necessarily a co-op.

Table 8- 2 Planning of Obligatory Passage Point

	Event	Actors	Actor Networks	Spokesperson
Problematization	The problematization was to find out how network connectivity can be achieved using wireless network solutions	**Human**: Bjarke Nielsen **Non-Human**: WLAN (technology), Houses	Bjarke/Technology artifacts	Bjarke
OPP	A Broadband organization needed to facilitate connectivity	**Human**: Members of the Boevl group, interested members **Non-Human**: ideas, technology artefacts, institutional actors	Broadband Coop	Broadband Internet connectivity

Williams (2015)

His initial idea as he mentioned in the interview was a Public Private Partnership, this was why he went to public and private sector organizations for help. However, he had a second plan. This was based on his experience with the boevl and the initial municipality project leading him to believe that people can facilitate these networks. This led him to start up a school to train people on how to make Broadband networks. Hence, identifying the actor network as Broadband coop is implied.

However, what Broadband internet connectivity was what he envisioned, will make new members who were not already members to join the network. Hence Broadband connectivity is identified as the spokesperson of the network,

Interessement: The actor needed to facilitate the OPP were Human, organization and Nonhuman actors as seen in the table below.

Table 8- 3 Actors invited into the network

	Human Actors	Organizational Actors	Nonhuman actors
1	Volunteers	Municipalities of Djursland	Technological artifacts
2	Board members	Danish Business Association	Ideas
3	Coop Members	Telecom Network Operator	Connectivity
4	Boevl Members	Internet Service Providers	Quality of Service
5		European Union	Money (funding)

Williams (2015)

The human actors needed were:

- **Volunteers**: They would help in the infrastructure installation and management of the coop
- **Board members**: They would run the organization
- **Coop Members**: The provided the needed economy for facilitating the network. Their interest in having the network made large scale wireless Broadband deployment possible.
- **Boevl Members**: Most of them were core volunteers and did aid Bjarke in bringing Djurslandsnet to reality. It is a fact that without them, there might not have been Djurslandsnet

The organizational actors were:

- **Municipality**: They were expected to adopt the project and aid in searching for finance and implementation of the project. The municipalities were willing but were constrained by Danish law. Hence they could not be a part of the network.

- **Djursland Business Association**: They were seen as major beneficiaries for such the wireless Broadband Initiative. However, they are customers of the network today. However, their inability to see the business sense in the Djurslandsnet plan led to failed negotiations between Bjarke's team and the Djurslands Business Association

- **Telecom Network Operator**: They initially meant to deploy the wireless Broadband network infrastructure. However, they found no business sense in the case.

- **Internet Service Provider (ISP)**: They were also meant to deploy the wireless Broadband network infrastructure. However, they found no business sense in the case.

- **European Union**: They provided funding for the network infrastructure.

Just like the case of MRIC. The nonhuman actors were mostly actors that would be used to enroll the identified actors in the actor network. Their role is discussed under enrollment.

Enrollment: This is the process where negotiation occurs between the Bjarke's team and the willing actors. Aside the Municipality, the Djurslands Business Association and Network operators (including ISPs), other identified actors were ready to join the network and accept their role in the Actor Network. The role of the non-human actors, identified in the table above, was important as well. At the enrollment process, non-human actors acted as mediators and intermediaries were coopted into the network to transport the force of action toward the development of the Actor Network. The mediators and intermediaries were ideas, technological artifacts, money, connectivity and Quality of Service.

- **Ideas**: The non human actor, "Ideas", was used to facilitate the development of the network and the invitation of would be volunteers, members, the municipality, the Djursland Business Association and the network infrastructure providers. Just as in the case of MRIC, Ideas had been mediators between the Bjarke's team and their vision. The outcome of the effect of the ideas was multi-directional. The negotiation with some actors was successful, while some other factors could not be convinced with the idea. However, the driving force in the Obligatory Passage Point was Bjarke's reliance on the strength of the ideas.

- **Technological artifacts**: The ease of use and deployment of technological artifacts to facilitate connectivity was vital. Based on Bjarke's previous experience and the experience of his Boevl team, they could demonstrate the possibility of Wi-Fi. This they did at conferences and seminars as a means to attract signatures to convince the municipality and the business community of people needing the network. However the simplicity of the technological artifact led to people deciding to deploy the network by themselves.

- **Connectivity and Quality of Service:** The growth of the subscriber base and the expansion of the Actor network relied heavily on actual connectivity and the Quality of Service. Connectivity and Quality of service as actors were intermediaries as they led to more members joining the network.

- **Money**: Money was an important mediator between the human actors and the facilitation of the network. Money was also an intermediary between the Bjarke's team and the deployment of technological artifacts to enable connectivity.

Mobilization: This is the process where every actor is fulfilling the function assigned to them and the MRIC actor network was formed. The spokesperson for the network was the Quality of Service provided by the network. This was similar to the case of MRIC.

IDENTIFIED PPI

One would not say that the case of Djursland is a PPI and not a PPP. The reason it is not a PPP quite, unlike the case of the Magnolia Road Internet coop which would have been a PPP, is that the EU subsidy was not a conscious public investment in the development of DjurslandsNet. In the case of the MRIC, they did source of state funding and the state was meant for facilitating telecom infrastructure delivery projects, if certain conditions were met. The state funding in this sense, such would have been meaningful as in the case of Almhult municipality meant for the project as the project would be valued and financed based on the value.

However, in the case of Djursland, it is Public Private Interplay as, one would say that even though the EU money was a drop in the ocean, it did pay some bills aimed at developing the private infrastructure. But the funds from explanation were meant for associations.

8.1.3 HALLARYD BROADBAND COOP SWEDEN

In order to serve the people better, the municipality has outstations at various locations in the municipality. In 2010, the municipality decided to invest 40 Million SEK to develop a fiber optic backhaul connecting the municipality office in Almhult city center to the outstations. Once this infrastructure was developed, the proximity of the infrastructure to people's homes led the municipality to design a Public Private Partnership framework that will facilitate FTTH infrastructure in the urban and rural areas of Almhult. At the time of writing this report, some parishes have already been connected.

One of the identified Coops is the Hallaryd Broadband coop. They were mobilized by the municipality to facilitate FTTH. Both cases are analyzed at the same time using ANT as they are connected. Analyzing them separately would lead to repetitions. In this section, the description will comprise of:

- Universal Access Regulation in Sweden
- Demographics of the rural area in Almhult
- Overview of the cases
- Organization and Financial arrangement
- Actor Network Analysis

UNIVERSAL ACCESS REGULATION IN SWEDEN

The Swedish regulatory environment with regards Broadband infrastructure delivery is well documented by Lindskog & Johansson (2005). The Swedish approach towards facilitating Broadband infrastructure began with the IT commission in 1994 (Lindskog & Johansson, 2005). This commission drafted the Swedish National IT policy in 1996 aimed at using Information Technology to promote creativity, growth and employment (Forsaetisraduneyti, 1999). The policy provided a framework on how ICT infrastructure can be facilitated by state action in facilitating rural Broadband connectivity (Lindskog & Johansson, 2005). This includes the central government subsidy support to municipalities to facilitate Broadband networks and tax reduction for individual subscribers (Lindskog & Johansson, 2005). This policy initiative has resulted in the Swedish municipalities being granted network access to a national backbone by developing their own fiber optic networks. This approach to Broadband infrastructure development still continues in Sweden and is documented in the Swedish Broadband Strategy (Regeringskansliet, 2014). It is under this regulatory framework that Almhult municipality was able to facilitate rural fixed Broadband network.

However, the Swedish approach is a combination of market interventions such as one mentioned earlier and the facilitation of competition (Regeringskansliet, 2014). Government interventions in Sweden are only utilized in areas where there is market failure (Regeringskansliet, 2014). Hence the public intervention has to be justified.

DEMOGRAPHIC BACKGROUND OF THE RURAL AREA

Almhult Kommun (municipality) is one of the municipalities of the Kronoberg County in Southern Sweden. In the south central section of the municipality is a small town also called Almhult. This is where the municipality office is located. The demographics of the rural area are as follows:

Population: The population of Almhult at the end of December 2013 was 15, 759 according to Alhmhults Municipality statistics (Statistics Almhults Municipality, 2014). The municipalities do not have administrative centers, hence areas in the municipalities are identified as either urban or rural areas. The urban areas are Almhult city, Dio, Liatorp, Eneryda, and Delary. 11240 people lived in these areas in 2013. 4563 people lived in the rural areas. Another way the municipality recognizes the areas is based on the State Church parish structure. The parish areas include Almhult Parish, Stenbrohult, Virestad, Göteryd, Pjätteryd, Hallaryd and Härlunda (Statistics Almhults Municipality, 2014). These parish areas include the aforementioned urban areas. The population distribution is expressed in the table below.

Table 8- 4 Population of Urban and Rural Areas in Almhult

	Urban Area	**Population**	**Parish Area**	**Population**
1.	Almhult city	9238	Almhult Parish	8747
2.	Dio	919	Stenbrohult	2650
3.	Liatorp	512	Virestad	1747
4.	Eneryda	311	Göteryd	1015
5.	Delary	216	Pjätteryd	636
6.			Hallaryd	520
7.			*Härlunda (Häradsbäck)	444
		11240		15 749

Source (Statistics Almhults Municipality, 2014)

It is important to note that the age bracket with more than 25 Percent of the population are between 25 and 64 years of age. The age bracket with less than 10 percent of the population is between 0 and 24 years old as well as 80 years old. The age brackets 16 to 19 years make up 5 percent of the population and 7 years to 15 years make up 10 percent of the population. The age bracket with the highest percentage is between 45 and 64 years, who make up 26 percent of the population.

Land Size: According to Statistics Almhults municipality (2014), the municipality's land size is 891Km^2. The population per square Kilometer is 18.

Average income: Information gathered from the interview at the municipality indicated that the average income of the citizens of Almhult per annum was between 240 000 Swedish Krones (SEK) and 500 000 SEK before tax.

Occupation: Most families are employed by IKEA, while others are civil servants, entrepreneurs or artisans. Still others are professionals who work elsewhere in Europe and own summer houses in Almhult. However, for residents permanently domicile in Almhult, only 50% have two persons in the family working full time jobs to earn the aforementioned annual income.

Geography: As mentioned earlier, the area of observation, when visited consists of forests (woodland), rocky soil, lake, streams and landscapes. It also consists of elevated country sides as well.

Education: Statistics from the Swedish Statistic service indicates that 58% of Swedes between the ages of 16 and 65 years old have good literacy, numeracy and problem solving skills corresponding to level 3 and above (Statistics Sweden, 2014). 44% of Swedes had good literacy and problem solving skills between level 2 and 3. This implies that the literacy rate in Sweden is quite high. This conclusion was adapted from Statistic Sweden from the Program for the International Assessment of Adult Competencies (PIAAC). The PIAAC scale ranges from 1 to 4/5 with 1 and above being the highest rank and 4/5 being the lowest.

OVERVIEW OF THE ALMHULT MUNICIPALITY CASE

In 2010, the Almhult municipality decided to facilitate FTTH connectivity to the parishes. This initiative became possible as a result of the municipality facilitating fiber optic connectivity to its out stations in the municipality. The proximity of the fiber optics network with to the parishes in the municipality provided the possibility for FTTH. The nine parishes in the municipality were organized into Broadband coops. Each coop was given access to Municipality and EU funding to facilitate the development of their Access network interconnecting with the municipality infrastructure (backbone). The municipality owned the backbone network and the coops owned the access networks. The municipality outsourced infrastructure development and management to Zitius, a Broadband infrastructure provider, for three years. As part of Zitius contract with the municipality, Zitius provided access to its sister company Quadracom to provide a briefcase of five ISPs, five IP telephony providers and two IP TV providers. The municipality wanted the citizens of the municipality to enjoy opennet services. Telia was first approached to manage the infrastructure and deliver the service, however, Telia was not interested in the open net. The company wanted to have exclusive Broadband service provision privileges. The relationship between the coops and Zitius is through the municipality. The relationship between the Municipality, Zitius and the Broadband Coops resulted in a Public Private Partnership discussed later in this section. Almhult municipality's decisions to facilitate FTTH connectivity in its domain were facilitated by the following reasons expressed in the table below:

Table 8- 5 Reason for Municipality Decision

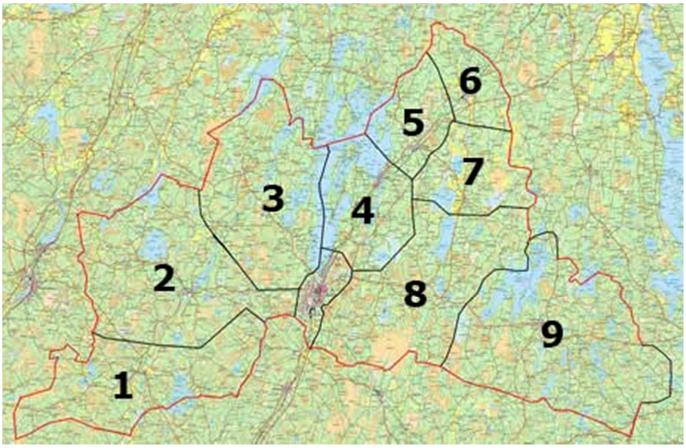
	Municpality Reason	**Explanation**
1	Sister Municipality FTTH Project	They had inspiration from municipality fixed Broadband initiatives in the northern part of Sweden and other parts of Sweden. This played a role in their opting for open networks.
2	Initial Municipality Wireless Broadband Project	They had inspiration from their previous attempt to develop wireless Broadband infrastructure which went well initially, but the cost escalated, when they had to order new spare parts; the fluctuating data rates and the need to set up antennas at elevated rooftops and hills to combat signal blocking by the trees of the forest.
3	Storm of 2005	They also had inspiration from the storm of 2005 which destroyed the Telia telephony infrastructure in some parts of Almhult such as Diö-Stenbrohult, Liatorp. Hence it was important to adopt an efficient telecommunication infrastructure that would not necessarily be affected by the weather elements.
4	Coop Initiative	Based on the bad experience of Diö-Stenbrohult and Liatorp after the storm, the citizens of these areas decided to form a community Broadband Coop to facilitate the provision of Fiber optic connectivity in these areas. The citizens of these areas arrived at this determination based on the following events. When their telephony infrastructure was devastated in 2005, Telia the then monopoly telecom service provider in the area had no incentive to immediately restore the damaged infrastructure for the following reasons:

5	Low population density	The figures in the table above would have been much lower in these areas in 2005. Even today the only area with more than 2000 inhabitants is Stenbrohult. Hence these areas had a low population density. The average number of permanent households, then was approximately 400 to 500. The other houses in these areas were mostly summer houses belonging to the Danes or Germans.
6	Low number of Telia customers	Few of the residents were Telia customers
7	Obsolete PSTN infrastructure	The equipment for the telecom network infrastructure was obsolete and the spare parts difficult to find as most of them had been there since the 70s.
8	Future change in technology	Telia forecasted that due to the change in technology, it would be a waste to rehabilitate the present infrastructure since Telia's reasons did not go down well with the residents who wanted the telephone infrastructure restored immediately. Telia's reluctance resulted in a law suit which revealed the fact that Telia had no legal Obligation (USO) to supply. Therefore, it was not mandatory for Telia to supply telecom services in the area if they decided not to. These decisions led the citizens to take matters into their own hands by planning fiber optic connectivity. The municipality saw this effort as a positive step as it pointed to the fact that the people could become proactive in infrastructure delivery if supported. Also in this manner, the municipality had people they could consult.
9	Proximity of the municipality backbone of local communities	As mentioned earlier in this section, the municipality did embark on developing a fiber optic network with the aim of connecting their outstations. Based on the proximity of the infrastructure to the different parishes, they decided to facilitate FTTH connectivity.
		Hence a mixture of market failure, natural disaster and the norm of municipality investment in FTTH in Sweden served as inspiration towards the facilitation of the Almhult Broadband Initiative.

Williams (2015)

ORGANIZATION OF THE ALMHULT BROADBAND PROJECT

The Almhult municipality Broadband project is led by the municipality. They have a special department that is in-charge of this project. This department relates with Zitius and Quadracom as well as with the co-ops. The coops are divided into 9



Parishes as seen in this map

1. Hallaryd, 2. Delary-Göteryd, 3. Pjätteryd, 4. Diö-Stenbrohult, 5. Liatorp, 6. Eneryda, 7. Virestad, 8.Bräthult, 9. Häradsbäck

Figure 8- 2 Parishes in Almhult Municipality

Source (Almhults Byanät, 2014)

Each Parish is led by a board of directors and a group of volunteers who are members of the respective Broadband coops. The co-ops charge 200 SEK annual Membership fee. Information from Hallaryd and Delary-Göteryd indicated that Hallaryd Broadband Coops, as mentioned earlier, consists of 170 members and Delary-Göteryd Broadband Coop consists of 250 members (DG Fiber, 2014). The website of the other associations was difficult to find online.

FINANCIAL ARRANGEMENT OF THE ALMHULT BROADBAND PROJECT

The financing of the project from the supply - side were as follows:

- Municipality funding of 40 million SEK
- EU funding

The project financing from the demand side were as follows:

- 20 000 to 25 000 SEK, paid by the customer for household access
- 1000 SEK for access to the technical house operated by Zitius for network repairs and depreciation

Still on the demand side, there were fees not for the facility deployment but for service delivery. These were as follows:

- 80 SEK monthly service charge per connection
- 200 SEK annual membership fee
- The charge for service used by the end user
- EU funding for coops.

ANT ANALYSIS

The ANT analysis of the Almhult Broadband Project is merged with that of the Hallaryd Coop Broadband initiative in the next section. The reason for the merger is because the facilitation of the Broadband Project was a joint initiative of both the municipality and the coop.

8.1.4 ALMHULT BROADBAND INITIATIVE SWEDEN

In this section, the regulation of Universal Service in Sweden is not discussed because it has been discussed previously, in section 8.1.3. The description of the case will be discussed along these lines.

- Demographics of the rural area in Hallaryd
- Overview of the cases
- Organization and Financial arrangement
- Actor Network Analysis
- Identified PPIs

DEMOGRAPHIC OF THE RURAL AREAS IN HALLARYD

Hallaryd is located 22KM, south west of Almhult city center. There are more than 130 to 150 permanent residents, excluding the owners of summer houses. The registered population of Hallaryd of the Alhult Kommun is 525 people. Hallaryd is not a recognized administrative area, but a former church parish area. Some of the residents work in Almhult as the proximity from Almhult is close by.

OVERVIEW OF THE HALLARYD BROADBAND COOP CASE

A young couple from Hallaryd answered an advert to attend a meeting at the municipality office at Almhult. It was at this meeting that the municipality officials laid out their plan for facilitating FTTH. The young couple were members of a small association in Hallaryd. It was at this association that they shared the news about the fact that the current communication infrastructure would be phased out as a result of it being obsolete and unreliable. The advantage of FTTH was that it was storm-proof and more durable. This led other members to attend the subsequent meetings to learn about the financial arrangement and deployment plans.

It was this first group of enthusiast that now placed a newspaper advert calling for a general meeting to form a co-op. Letters were sent to mailboxes of residents. This was possible because Hallaryd is a small community of permanent residents. The selling point was that there was a storm proof communications technology to be facilitated. The EU subsidy and the municipality funding made the financial obligations of the citizens lesser. Hence the first group of enthusiast formed the Hallaryd Broadband coop. The coop grew to include non-permanent residents as well, leading to the breaking of the coop into four sub-coops to avoid procurement for digging. They preferred to have the digging done by locals to provide employment for residents. As a single co-op, if they raised a minimum of 200 000SEK, they had to procure the digging. However, they have a central board with sub-boards and they hold their general meeting as an enlarged group once a year.

This was how the Hallaryd Broadband coop was formed.

ANT ANALYSIS THE ALMHULT BROADBAND INITIATIVE AND THE HALLARYD BROADBAND CASE

Adopting the Michael Callon Framework, the retracing of the actors and the events will be described with regards Problematization, Interresement, Enrollment, and Mobilization.

Problematization: In “problemizing”, the municipality decided to take a second look at how to handle the telecom infrastructure problems in the municipality. The municipality politicians created an Obligatory Passage Point (OPP) towards attaining FTTH. To create the OPP the municipality was faced with some critical factors:

- Who will provide technical management of the network?
- How does the municipality to ensure that the equipment needed by the coops is provided at an affordable cost?
- How can the high cost of providing FTTH be subsidized?
- What is the selling point that would make people agree to join the initiative?
- How can equity in subscription be achieved?
- How can the coops be formed in a municipality where there is no formal internal zonal municipality administration?

Questions 1, 2, 3 and 4 were very important as they served as incentives that would lure the residents of each area to be a part of the initiative. The people obviously would not be technical experts; neither would they want to be a part of the cost of getting the equipment that was not affordable for them. Even though they could afford to buy the customer premise equipment, they had mobile telephony- although the reception was not good. At least they could go outside or drive to hill to communicate with their mobile phones if the mobile reception was poor. Hence, they would not be willing to spend money on an expensive fiber optic connectivity if it was not heavily subsidized.

The subsidy provision was still not enough in this case, as the municipality politicians understood the constituents. It was mentioned in the interview with the municipality contact person that residents of the more remote areas were more willing to embark on community action that residents in larger villages who understood that it was the municipality’s duty to provide basic amenities and not the other way round. To enable social inclusion, the people in the larger villages could not be left behind; hence the municipality understood that dangling the subsidy ‘carrot’ alone would not do the trick. Based on this fact the selling point, that technology would change in a few years and that the current infrastructure was at the mercy of natural disaster became the selling point. One would say at this point that natural disaster became a mediator in the actor network.

Questions 5 centered on how the initiative can be sustained in terms of interconnectivity between the coop fiber optics and the municipality fiber optics. Question 6 brought up the challenge of how to organize the co-ops around un-existing boundaries.

Hence the OPP entailed the operation of the municipality infrastructure, the creation of the community fiber optic infrastructure, the creation of a consortium of Broadband infrastructure and Service Provider (in PPP this is a Special Purpose vehicle (SPV)) and the seamless interoperability of the three entities.

In the Operation of the municipality infrastructure, the municipality decided to outsource its fiber optic network for a 3 year period to a private entity through a form of PPP known as Public DBO. The duty of the private entity was to operate and maintain the municipality fiber optics as well as provide technical services to the coops via the municipality’s request.

The private sector provider was obligated to provide an open network for the SPV, where there is at least 5 Internet Service Providers (ISPs), 5 IP Telephones and 2 IPTV Service providers delivering their services to the end user. This was aimed at fostering competition, which did not exist in some Broadband networks in northern Sweden provided by Telia. The Almhult municipality did not want to provide connectivity and services where users had no choice. The municipality also made sure that the contracts were temporary, so that at the end of the contract, if the users were not satisfied the municipality could decide to bring in another provider.

In the creation of the Broadband coops, the municipality identified the need for a municipality subsidy of 40 Million SEK (Swedish Krones), EU funding Channelled via the Kronoberg County, the subsidization of the equipment bought by the coops, the introduction of the flat access rate of 20000 SEK to 25000SEK for all the co-ops and finally demarcating the areas along the boundaries of the old Church (Parish) System- as people still identified with that system even though it is no more official.

Hence the identified actors for the Obligatory Passage Point were the municipality, the private sector that provides gateway connectivity to Almhult, the private sector entity that would manage the infrastructure, the Private sector entities that will supply the Broadband Services via the infrastructure, the EU funds, The EU Policy, the Kroneberg County, municipality funds, the Fiber infrastructure, the Broadband coops and natural disaster.

Interessement: In persuading the actors to accept their roles in the network, the municipality adopted the following process as seen in the table below:

Table 8- 6 Interpositioning (interessement) of Actors

	Actor	Intressement
1	Gateway provider to Almhult	Tele2. They were not chosen by the municipality. They happened to have their infrastructure already providing connectivity to Almhult. Hence, as the monopoly gateway provider, they became part of the network.
2	Broadband Network provider	Telia, Tele2 and some other companies were the first company the municipality negotiated with. Telia as it was a former national monopoly. Telia did not like the idea of an open network, hence the works department of the Almhult Municipality in 2013 accepted tenders from Zitius/Quadracom, Open Universe, Net at Once and Wexnet (Almhult Kommun, 2013). Zitius was chosen.
3	Broadband Service Provider	As part of the agreement between Zitius and the municipality, they had to open their networks to Broadband Service providers. Zitius has a sister company Quadracom that provides a platform for different Broadband service providers to supply via their network. Some of the providers include, Viasat, Tele2, Riksnet, Bahnhof and lots of other service providers. Almhult users could access Quadracom's partners on one platform www.qmarkets.se to make their choice. They were interessed into the network together with Zitius
4	EU Funds	EU funding was persuaded into the network in two ways. Each way was of use to the coops. The treasurer of the Hallaryd Fibernet informed that the EU supports developmental coops annually for admin costs. On the other hand the EU via the Swedish Board of agriculture in the Kronoberg County, funds accounted for 50% of the cost of digging. This funding mechanism played a huge role in the rapid implementation of the project. Funding here was an intermediary actor in the network.
5	The EU Policy	The EU funds were made possible by the EU supporting the development of telecom infrastructure in places that are not commercially viable. Hence, without this policy, there would be no EU funding for such an initiative. However, in this network, the policy is a mediator because its implications could be implemented in different ways aside just funding such initiatives as community Broadband networks. It is this policy

		that also enabled the municipality to intervene in the provision of FTTH in Sweden.
6	Kroneberg County	The County was another intermediary actor in the network as it administered the EU funding to the Coops.
7	Municipality funding	The municipality aid provided to the project is also an intermediary actor aimed at cushioning the cost of the coops.
8	The fiber optic infrastructure	The municipality fiber optic infrastructure was persuaded into the network by interconnecting it with the parish networks to become one big technical artifact. The parish fiber optics were persuaded into the network not just via interconnectivity, but also using the coops as an intermediary actor to facilitate the network as well as connect it to the larger network.
9	Broadband Coops	The interessement of the coops varied from coop to coop. From the municipality point of view, they had to use the chairmen of existing coops such as Diö-Stenbrohult and Liatorp parishes to persuade and negotiate with people selected at random from some small, informal associations in different parishes about the advantage of the fiber optics network, the fact that technology is changing and fiber optics is the key to the future and ultimately it is natural disaster proof. The chairmen of the existing coops were used because, one would say, they 'spoke the language of the people' and they were also organizing themselves, which proved that it could be done. The attendees were informally initiated into a call to action. The interessement for Diö-Stenbrohult and Liatorp were easier as they were in the process of providing FTTH for themselves before the municipality took the initiative. Hence the municipality involvement was a relief to them. The chairman of Diö-Stenbrohult was co-opted to work with the municipality in the project and today he is handling the project. However, in Hallaryd, where the individual that attended the municipality meeting were a couple, who gathered people they knew to spread the message. One would say that they, just as people from other parishes such as Delary-Göteryd, Pjätteryd, Eneryda, Virestad, Bräthult, and Häradsbäck were also developing their actor networks. However, each actor network would be punctualized as black boxes to act as actors to fulfil the desire of the municipality, however based on the sustained interest of

		the punctualized actors. However, narrowing down to one network, Hallaryd, the couple and their friends invited other neighbors and friends to their meetings to discuss the municipality proposal. Here semiotic actors such as interest of young people, and high internet capacity synergized with the unhuman actor natural disaster to persuade the initial group of enthusiasts or as Rogers would call it early adopters (ref), to sign up to be a part of the initiative. Further intermediaries such as letters in mail boxes inviting people for meetings and newspaper adverts were released by the Hallaryd coop to invite more people to join the initiative. They elected their executives and the members agreed on the obligation of membership, and the actor network was formed, hence they could now relate to the municipality.
10	Natural disaster	Natural disaster played a pivotal role in this actor network. However, its role was not active but passive. Actors in the network had to be reminded that the passivity of natural disaster here should not be regarded as it does not exist. The disruptive nature of natural disaster in previous actor networks meant, there was the need to expunge it from the network. However, one would say that even though natural disaster was a passive and an unpredictable actor, it still produced fear. Hence, one cannot overlook its role in the network. Hence the natural disaster was interessed into the bigger municipality and small community actor network by the lead actors in these networks informing the people about the existence of natural disaster. The past experience of the residents of Diö-Stenbrohult, and Liatorp, were glaring for all to see.

Williams (2015)

Enrollment: Once these actors were persuaded to accept their roles by the municipality and the leaders of the coops, the next step was the persuasion by the lead actors for the interresed actors to act their role. Zitius bought Capacity from Tele2 and redistributed it to the municipality and Broadband Coop networks. They provided Open Access to Quadracom to facilitate the provision of the Broadband Services to the people of Almhult. They also managed the technical houses in the different parishes. Hence, within the 3 years they finance, maintain and operate the infrastructure.

The municipality serves as the ‘middleman’, here by not only supporting the co-ops, but charging the coops 80 SEK per connected household as interconnection fee. The fee goes to both the municipality and Zitius. They also charged 1000 SEK per year on behalf of Zitius to enable Zitius maintain the coop networks. They accept orders from the co-ops and gets Zitius to provide the orders at an affordable cost for the coops. The co-ops pay for the orders for their fiber optic network.

The co-ops initially had to raise 200 000Sek for the digging. If they raised more than that amount, they had to procure. In the case of Hallaryd, they had to break the coop into 4 coops with a common Secretary and treasurer; the chairmen in each coop were also executives in the other co-ops to maintain a sense of unity. The executives are elected after every year. This implied that they could not raise 200 000 SEK per co-op, hence they could hire the digger of their choice without having to go for procurement of diggers. The coop had between 150 to 170 members altogether and Hallaryd is home to about 350 permanent residents. In Hallaryd, each member paid 25 000SEK per connection and the co-ops handled the right of way agreement among themselves. They have a municipality officer that goes there once in a while to oversee how each coop is coping.

The coops are sustained by their annual contributions as well as the EU funding. They receive the EU funding after presenting an invoice. This implies that they raise the money to pay upfront and the EU pays them back the money. The co-ops also get the list of subscribers for each Broadband service from the service provider, the bills are sent to the subscribers and the coop pays the bills in bulk.

Mobilization: Every actor in this network, aside natural disaster, whom one cannot say what it thinks have accepted the role outlined in the OPP by the municipality for them. So far one would say that the Almhult municipality Broadband network Actor Network is at the moment stable. The first phase of the project ends in 2015 when every possible parish is connected and the municipality would then decide how to proceed with the network.

IDENTIFIED PPIS

The Almhult case, unlike the other cases mentioned so far was designed in the form of a Public Private Partnership. In the course of the interview with the municipality officer, it was mentioned that the municipality had an earlier PPP agreement with Tele2 to provide fiber optic connectivity to a newly constructed council facilitated accommodation in Almhult city in 2010. The PPP agreement involved tele2 providing fiber optic connectivity to the area on behalf of the municipality and to hand it over after a ten year concession. This was the Build -Own - Operate Transfer (BOOT) form of PPP. Hence the municipality had an experience with organizing PPPs.

This PPP is in 2 forms. The first is the Public DBO form of PPP, where the public sector builds and owns the network and leases or rents out the infrastructure to the private sector for a period. At the period of the rent, the private sector has full control over the infrastructure. The public DBO is evident in the management and maintenance of the infrastructure owned by the municipality. The relationship here is between the profit oriented private sector represented by Zitius and Quadracom and the public sector. In this first form of PPP, the public sector (The municipality) provides governance in terms of guidelines as to how the infrastructure would be used, they provide financial incentives as well as the infrastructure. The private sector (Quadracom) provides the services, they (Zitius) manage and operates the municipality infrastructure, bringing in their management expertise to bear. Zitius will also bear some transaction costs as well as it is given a free hand to run the business.

The second form of PPP is the private DBO, which is adopted for the development of the infrastructure owned by the co-ops. The co-ops here are a private entity, but they are not a profit making entity. The infrastructure is designed, owned, operated and maintained by the coop. Here the infrastructure is jointly financed initially by the co-op, and an enlarged public sector, which includes the EU and the municipality. The coop and EU financing facilitates the digging (creating a right of way), the sourcing for materials for the fiber optic connectivity. The municipality provides the fiber cables, provides subsidy to aid the coops in laying the fiber optics. The municipality also facilitates Zitius and Quadracom on behalf of the coops. The overall regulation of the coop aside other internal regulation is provided by the municipality as well.

Aside the aforementioned PPP, other PPIs can be identified, such as Service contacting. Here the municipality had a service contract with a private operator to develop the initial municipality backbone. The second form of PPI, which is in the form of public provision of governance, emanates from the EU policy which is adopted by the Swedes, which permits the municipality to invest in telecom infrastructure in areas where commercial interest cannot supply. This policy provides a room for creating incentives that would attract private investment in rural areas that are not commercially viable. Still on the part of governance, there is a low entry barrier for the coops and Zitius to operate in rural areas facilitated by the municipality. One would also mention the liberalization policy in Sweden, which would permit more Broadband provider to deliver their services in Almhult. However, liberalization is not directly evident in this case as other competitors to Zitius, providing parallel services are yet to enter the Almhult Broadband market. But there is room for more competitors.

Hence, from these identifications, one would say that the Almhult case is a two-sided PPP as well as a PPI with different facets as explained earlier.

8.2 DEVELOPING COUNTRY CASES

The ANT is used as a descriptive and analytical tool to describe the primary cases situated in the developing countries. In each case the story behind their implementation is described. The organization and financing arrangement of each case is described as well.

8.2.1 JOHANNESBURG WIRELESS USER GROUP SOUTH AFRICA

The analysis in this section is for the Johannesburg wireless group. Today JAWUG is a single entity that portrays a bottom-up approach towards the supply of Broadband Internet service in Johannesburg. The ANT identifies a network whenever is action is redistributed. This redistributed action as mentioned earlier are caused by the various actors that interact with the network. In this section, the description will comprise of:

- Universal Access Regulation in South Africa
- Overview of the case
- Actor Network Analysis
- Organization and financing of the case
- Identified PPI

UNIVERSAL ACCESS REGULATION IN SOUTH AFRICA

In 1996, South Africa enacted their first telecom regulatory and institutional framework with the telecom regulations Act (South African Legal Information Institute, 1996). The act established the South African Regulatory Authority, as the regulator of the South African telecom sector. They were mandated to regulate, Universal Access and Service interconnection, Spectrum, telecom equipment, suppliers and technicians (South African Legal Information Institute, 1996). The regulation was mandated to regulate Universal Access and Service via provision of under-served area licenses for small businesses, people from disadvantaged groups or individuals and the provision of Universal service obligations to incumbents. The regulator served as an arbitrator in interconnection disputes as the Act allows the network operators to negotiate interconnection agreement. The law did not enforce interconnectivity as a party could refuse to interconnect if it is technically feasible, it can be implemented on a reciprocal basis and it will promote the efficient use of the network infrastructure (South African Legal Information Institute, 1996).

Parties who felt aggrieved if they met the prescribed criteria were advised to contact the regulator for arbitration.

The law also established the Universality fund. The Universality fund is funded by 0.5% annual return of incumbent operators. Universality fund projects funded via subsidies are facilitated via competitive public tenders. Aside the institutional and regulatory framework, one of the aims of the Act was to facilitate Universal Access and Service via a competitive market.

In 2000, a year, before the establishment of JAWUG, the sector specific regulator was merged with the Broadcast regulator by amending the telecom regulation Act of 1996, the Independent Broadcast Authority Act (1993) and the Broadcast act of 1999 (ICASA, 2000). However the Electronic communications Act of 2005 replaced the Telecommunications act of 1996 (Ellipsis, 2010).

This was the regulatory background that existed, when JAWUG was formed.

BRIEF OVERVIEW OF CASE DESCRIPTION

In 2001, Kieran Murphy a computer science student living in East Johannesburg, mobilized his colleagues living in the same street to implement a Wi-Fi network that would enable them to play video games as well as collaborate remotely online for their educational project. In this manner they could play games online at a much lower cost than what was made available. In those days in South Africa, the cost of accessing the internet via 64kbps dial up modem was high.

The successful implementation of this wireless network on the street led their colleagues and their neighbors to see the gaming and data possibilities made available by Wi-Fi. By word of mouth advertisement of this innovation was made. This led people around with similar and different communication needs to desire a connection. At the same time in other parts of Johannesburg, Cape town, Durban, Pretoria and other urban centers in South Africa, there were other 'Kieran Murphy's' dabbling into the new technology leading to the springing up or what they called, wireless user groups.

In 2006, these wireless user groups became a source of internet provision to people in some urban areas of South Africa. In the same year, splintered groups from different parts of Johannesburg merged to form the Johannesburg Wireless User group, providing Broadband Internet access to these areas.

This group still exists today and an interview was conducted with the chairman of the group. Mr Neil Govender. A synthesis of the interview is attached as appendix B.2.1 of this report. Based on this interview the ANT is used to extract the evolution of the Actor network.

It is important to note that JAWUGs coverage extends to rural Johannesburg, but they have been finding it difficult to get members there. This is because they do not have the money to subscribe to JAWUG services. Hence Neil Govender believes a wider Government effort in facilitating similar wifi initiatives will work, especially with the high cost of WiMAX in rural South Africa supplied by Network operators.

A greater detail on the case description is done with the Actor network theory.

ANT DESCRIPTION OF CASE

The JAWUG Actor network emerged as a result of a process of the building and punctualization of different Actor networks into one heterogeneous network. The punctualized networks became black boxes and hence actors in a much larger network. The reason for this is because, the growth of JAWUG was not intended as described earlier, rather it was accidental. It was the prospect and usefulness of the network that led to the growth of the network.

In making the ANT analysis, using the framework by Michel Callon, an attempt is made to identify earlier networks that became punctualized to become an actor in the enlarged network. This analysis will not go into the depths of every network that became punctualized, rather, the significant networks that portrayed and attempt towards facilitating the network will be analyzed. Hence the ANT analysis is divided into three phases namely:

- The Geek Network
- The Wnet Network
- JAWUG network

INITIAL ACTOR NETWORK: THE GEEK NETWORK

This is the actor network that involved Kieran Murphy and his friends. Adopting the Michael Callon Framework, the retracing of the actors and the events will be described with regards Problematization, Interresement, Enrollment, and Mobilization.

Problematization: In school Kieran Murphy and his friends, Justin Jonker, Ross Clarke and Steven Carter (referred to as the Geeks) learnt about 802.11b standards (Wi-Fi) and the possibility of using the free 2.4GHz to 5.8GHz to transmit the 802.11b standards. As gamers, they problematized thus:

- Was this technology viable for playing games?

- As a 3rd year computer science students can we collaborate on this platform for our computer science project?

They created an Opportunity Passage Point (OPP) aimed at experimenting if what they learnt was feasible. Hence the OPP involved setting up a Wi-Fi wireless network that connects their homes. The spokesperson for this network was the fact that they would actually play games online and collaborate on their homework.

The human actors were the Geeks and the non-human actors were 802.11b technology artifacts (hardware and software), their Personal Computers, their knowledge and expertise

Interessement: The next step was to interpose the technological equipment by purchasing the equipment, which included 802.11b radio equipment, 24dbi 24GHz grids, Orinoco Wavelan PCMCIA cards and PCI-PCMCIA cards. The Geeks brought in their knowledge and expertise to play on which equipment to buy. Their knowledge and their expertise were intermediaries between the Geeks and the technological artifacts.

Enrollment:The enrollment process involved the facilitating of connectivity. The result of this process was the ability of the technical network to deliver 11Mbit/s data rates via. An upgrade of the radios to some Gigabyte APS, interconnected with WDS produced 22Mbits/s.

Mobilization: At the mobilization stage, the connectivity was established between the homes of the geeks. The Actor network involved the Geeks and Wi-Fi wireless artifact. The spokesperson for this network was the Quality of service of the network. Other neighbors saw the usefulness of the network and advertised it to others by “word of mouth”. The Geeks had no plans of expanding the network, but “word of mouth” became a mediator that led to the development of a larger network- The WNet Network. At this transformative point, the Geek network is punctualized into a black box- although the actors in the Geek network are still active.

EVOLVED ACTOR NETORK: THE WNET NETWORK

Word of mouth connected existing actor network with their colleagues in the university. In those days with the low data rates provided by the incumbent national telecom monopoly, Telkom SA, the action of the non-human actant 802.11b generated interest, hence there was a need that led to the growth in interest for the network. Adopting the Michael Callon Framework, the retracing of the actors and the events will be described with regards Problematization, Interresement, Enrollment, and Mobilization.

Problematization: As word of mouth led to new actors such as the friends from university and neighbors becoming interested in the network, the problematization of the network also changed. The new problematization was "if we extend this street network to extend connectivity the Eastern part of Johannesburg so that friends from university and neighbors could sign up, will it work?"

The ObligatoryPassage Point was that a wireless 802.11b signal will provide connectivity to the Eastern part of Johannesburg using Volunteer help and volunteer donations. The goal of connectivity here became Eastern connectivity. The Actor network informally christened itself WNET. The interest from neighbors and university colleagues implied more unofficial volunteers. The non-human actors were similar to that of the Geek network. The only addition was the need for radio towers to aid in long distance transmission. The leading Actors were the punctualized Geek Network, as they had the knowledge of extending the network.

Interessement: The next stage was the interessement the identified actors in the new Obligatory Passage Point for WNET. The Geeks used their resources in addition to resources brought in by those who needed connectivity to draw up network expansion plans. They used hills to position the towers needed to facilitate a backbone network. They also had a negotiation with the owner of an Amature radio mast at Dawn View Hill. The owner was magnanimous to grant space for the mounting of the antenna on the tower space. At this point, the antenna was persuaded into the actor network.

Enrollment: The possibility of elevated antenna deployment led to the Geeks extending the network to Eastern Johannesburg. As envisaged in the Obligatory Passage Point (OPP), volunteers signed up to aid in the deployment and providing finance. They met monthly for technical meetings. There was no monthly subscription nor access fee nor organization at this point.

Mobilization: At the Mobilization Stage, extended Broadband connectivity in Eastern Johannesburg became the spokesperson of the network by right. However, there was the need for interconnecting with other wireless networks. This was necessary because WNET could not interconnect with Telkom SA for traffic emanating from Telkom, but it was possible vise versa. The South African incumbent Network Operator. Hence, interconnecting with other Wireless Network was an option as WNET grew to become the largest network in eastern Johannesburg.

THE STABLE ACTOR NETWORK: JAWUG NETWORK

The need to interconnect led WNET towards seeking alliances which metamorphosed into JAWUG. Adopting the Michael Callon Framework, the retracing of the actors and the events will be described with regards Problematization, Interresement, Enrollment, and Mobilization.

Problematization: On the Western part of Johannesburg, the largest network was the Wild West Mesh. In the interview conducted with Neil Govender, he indicated that there was a desire to interconnect with peer networks. This had to be done by creating a wireless link that links the 2 networks. In one of the meetings, they (WNET and Wild West Mesh) discussed the merging of the network to achieve economies of scale as well as create a proper an administrative structure for the merged body. These desires led to several meetings held between the various networks which led to the decision to merge the networks into a single network called JAWUG. The merger would involve having a central board (JAWUG Management Team) being assisted by a team of volunteers. The volunteers (JAWUG Core Team) would be divided into different areas of Johannesburg to aid in maintenance and customer service help. These desires became the Obligatory Passage Point for WNET, Wild West Mesh and few smaller networks.

The facilitation of the Obligatory Passage Point was aided by consultancy efforts of the Internet Service, the Wireless Internet Service Providers Association and the Wireless Applications Providers. They provided support on technical matters, the framework for handling the free 802.11b spectrum and policy development.

Interessement: At the interessement stage, the new association JAWUG agreed to facilitate Line of Sight (LOS) connectivity between the WNET technical network and the Wild West Mess Network. This was done by locating a high hill in the middle between the East and West of Johannesburg. The North Cliff Ridge was the suitable spot for the LOS equipment. Wild West Mesh and WNET, and the smaller networks were willing to disband and join a more formalized network under the name JAWUG. A new constitution was formed, JAWUG was formally registered as a Broadband Coop and officials elected. The constitution also mandates JAWUG members to pay annual membership fee, whether they are connected to the network or not.

Enrollment: At the enrollment stage, in 2006 the LOS connectivity was successfully facilitated linking the East and Western technical meshes of the now JAWUG network. JAWUG was formed and it became an entity. This implied the punctualization of the WNET, Wild West Mesh and other Broadband networks in Johannesburg that were part of the pact. The elected actors of a new Black box, the JAWUG Management board and the core team accepted their roles and acted it out voluntarily without pay. The members also begin to pay annual membership fee. JAWUG members do not pay subscription fees.

Mobilization: At the mobilization stage, the constitution became the spokesperson for the organization, while the JAWUG management team became the mouthpiece of the constitution. At this point a Macro network is formed.

ORGANIZATION AND FINANCING OF JAWUG

Based on the ANT description, JAWUG is organized and financed as follows

Organization: JAWUG is made up of a Central Management Committee. This is made up of no less than 6 persons. The officers include, the Chairperson, Secretary, treasurer and 3 office bearers. They are elected for a period of 1 year and cannot go beyond a third term. They administer the organization. The body that handles the technical administration of each area is the core team. These are volunteer members living in each area. They maintain and manage the network in the areas as well as respond to user needs. The board and the core team are all volunteers.

There were actors that were invited to join the network but did not. That included Government and the regulatory agency. This was because there was a lot of bureaucracy involved anytime they were contacted. This led to delays. The Network Operators do not allow the community networks to interconnect with them as it is not allowed by law. However, the competing Broadband industry in South Africa is Keeping JAWUG on its toes. JAWUG at the time of the interview had about 2000 members.

Financial arrangement: The group is financed from Annual Membership subscription, money from advertisers as well as donations. This includes actors that provide private donations (they could be members of the JAWUG, who are businessmen or an outsider), Advertisers (people who advertise on JAWUG platforms) and hardware providers. The Internet Service Providers provide bandwidth free of charge to JAWUG. JAWUG and other wireless groups interconnect among themselves at no cost as a means of lowering the final cost.

IDENTIFIED PPIS

This case is unfortunately not a PPP as there was no direct or indirect involvement of the public sector in the delivery of Broadband infrastructure. However, one would say that it is a PPI in a very loose sense of the word. The public contribution to this PPI would be the deregulation of Wi-Fi as well as not identifying community Broadband networks as competitors to private (profit-oriented) Broadband providers. However, this PPI is not unique as it found globally. However the case as would be mentioned in the discussion segments has the potentials of being a PPI.

8.2.2 DHARAMSALA WIRELESS NETWORK (AIRJALDI) INDIA

The analysis in this section is for the Dharamsala Wi-Fi Network. The background of this network is tied to the parent company Airjaldi India. AirJaldi according to the founder of the network Yahel Ben-David is a Hindu word for Speed. The case description is based on the document and videos sent by Yahel Ben-David and the interview conducted with the co-founder and Chairman of Airjaldi Jim Forster. The Dharamsala network is one of AirJaldi's 5 networks, located in 4 states in India. Excerpts of the interview are attached to this report. Dharamsala is a municipality in the Kangra District in the state of Himachal Paradesh in India. In this section, the description will comprise of:

- Universal Access Regulation in India
- The demographic of the rural area
- Overview of the case
- Actor Network Analysis
- Organization and financing of the case
- Identified PPI

UNIVERSAL ACCESS REGULATION IN INDIA

Telecom infrastructure development in India is facilitated primarily by promoting market competition. Competition is promoted by the liberalization of the telecommunications market. The competitive market was initially facilitated by the Directorate of Telecommunications (Noll & Wallstein, 2005). However, in 1997 the Telecom Regulatory Authority of India (TRAI) was established by the Telecom Regulatory Authority Act of 1997 (UNPAN, 1997). In recent times TRAI has facilitated a competitive market by granting Unified Access Service licenses for Basis Services and cellular service to Basic service operators (USO operators) (Telecom Regulation toolkit 891, 2006).

To supplement the competitive market in commercially viable areas, the Indian Government has also made efforts to intervene in rural telecom infrastructure delivery via public investment. In 2004, the Indian National Telecommunications policy proposed the establishment of the universality funds (Noll & Wallstein, 2005). This fund agency provides subsidies to infrastructure providers delivering their services in rural areas. The firms eligible for subsidy are determined via subsidy auctions (Noll & Wallstein, 2005). The subsidies are awarded by reimbursing the net cost incurred by the infrastructure provider. The infrastructure provider with the lowest bid, provided that the bid is not higher than the set benchmark, receives reimbursement. The winner receives subsidy for seven years, subject to review after three years.

Airjaldi did not apply for reimbursement as they did not meet the threshold to join the subsidy auction.

A SNAPSHOT OF THE DEMOGRAPHY OF THE RURAL AREA

A brief demographic information on Dharamsala is presented below.

- Population: 136 536
- Households: 31 328
- Average household size is 4.4.
- Literacy rate: 85.8 %
- Nonworkers: 83 558

Source (Census Info India, 2011)

OVERVIEW OF CASE DESCRIPTION

In 1998, Yahel Ben Israel was invited to India to develop an Internet network at Dharamsala where the Tibetan Government in exile are domicile, by a friend. His task was to provide connectivity in the rural areas. He already had experience setting up Internet Service Providers in most parts of the world. Hence he hoped to stay for a short while. However, on arrival in India, that changed as he saw the great need of the people. The first identified need was how to connect NGOs using wireless Broadband connectivity. One NGO had access to Internet connectivity in the rural area via satellite. This was an expensive solution, so other NGOs scattered in the area were not able to afford such connectivity. However the NGOs collaborated by sharing the cost of the satellite link, but they had to visit the NGO with connectivity, download the information needed and transport the floppy disk back via motorcycles. Yahel set out to connect these NGOs with bandwidth provided by telecom network operators and big corporations. This is because in India before the deregulation of Wi-Fi, only big corporations and Network operators had access to the expensive radio license.

In January 2005, India deregulated Wi-Fi and that provided Yahel the opportunity to begin setting up mast and wireless antennas on the rooftop of the NGOs in Dharamsala. The satellite link provided gateway connectivity and the point-to-point and point-to-multipoint radio links were used to connect the NGOs. The connectivity was then extended to other schools and other organizations. The silicon chips in routers connected to antennas with innovative software modifications allowed him to link stations hundreds of kilometers away with fast bandwidth. Yahel observes that the bandwidth was faster than what most Broadband providers allow today. He ordered more of the home routers and disassembled them in order to build the outdoor antennas. His wife tested the IP phones by calling her friends in Israel. Yahel's Initiative was initially known as Rural Broadband.

In 2006, it was time for India to organize a workshop in continuation of the international conferences that occurred in Berlin, London and Djursland. The essence of the conference in India was to learn about the Dharamsala network in India. Jim Forster got involved as a member of the planning committee of the conference. He visited India and tried to understand how Rural Broadband with a low cost structure could provide good internet for the people. They muted the idea of transforming the social project into a commercial entity. Michael Ginguld, a friend of Yahel, who had previously lived in Dharamsala for some time earlier, was also invited to join the project. Michael had an experience in non-profit organizations and advocacy groups. Their take off date was slated for 2009. The brand name Airjaldi was adopted and the company was commercialized as Rural Broadband Pvt (Delhi).

AirJaldi networks have gone beyond Dharamsala today to Kangra Valley, Himachal Pradesh; Terhi Garhwal District, Uttarakhand; Kumaon District, Uttarakhand; Ranchi District, Jharkhand; Thanjavur District, Tamil Nadu; Byalkuppe, Karnataka; and Mundgod, Karnataka.

They provide the Broadband Services to Schools, commercial centers, banks, Business Process Outsourcing (BPO) and towards buildings (Public and Private) as well. They buy wholesale bandwidth, redistribute it on their network and retail it to the end user. They deliver 256 Kbps, 512Kbps, 1 Mbps, 2 Mbps and 4 Mbps to their customers.

ORGANIZATION AND FINANCING OF AIRJALDI

Before the commercialization of the Airjaldi brand, it was funded by Yahel, he and a group of volunteers worked together. After the commercialization the entity works more as a private profit making entity.

ANT ANALYSIS OF THE PRE-COMMERCIALIZATION PHASE OF THE CASE

The ANT analysis is focused on the pre-commercialization phase of Airjaldi. This is because the pre-commercialization phase exposes more of a people oriented bottom-up approach. The analysis of the commercialization phase carried out with Grounded Theory in chapter 9. Adopting the Michael Callon Framework, the retracing of the actors and the events will be described with regards Problematization, Interresement, Enrollment, and Mobilization.

Problematization: As mentioned earlier, the only form of Internet connectivity in rural Dharamsala was the NGO's VSAT connectivity. On arrival in India, Yahel decided on an Obligatory Passage Point where the NGO's VSAT connectivity could be extended to the other NGOs. He also "problematized" on how he could extend bandwidth connectivity wirelessly into Dharamsala to facilitate Broadband Internet Services for the rural area. The identified groups of actors to aid in facilitating connectivity using the Obligatory Passage Point were personal volunteers, his wife (for testing IP telephony connectivity), the necessary radio equipments, Wi-Fi laptop cards, antennas, schools, businesses/commercial centers, individual homes, his personal finance and his knowledge of wireless network configuration.

Interessement: Yahel assembled the necessary equipment and personnel needed for the test. He facilitated the NGO connectivity and also tried out several tests. He had to rely on satellite transmission to facilitate connectivity as Wi-Fi spectrum was not yet deregulated in India. Also bringing in laptops with Wi-Fi cards in bulk into India was illegal in those days. He fabricated some of the radio equipment using the silicon chip in the Wi-Fi card to make wireless routers. With this he was able to utilize the Wi-Fi radio spectrum to test his network with the help of his volunteers. His wife helped him to make test calls.

Enrollment: The successful testing of the network, led to Yahel starting an NGO. The non-profit organization facilitated Internet connectivity to schools, businesses and to places in Dharamsala where he felt needed connectivity. This activity occurred till Wi-Fi spectrum in India was deregulated in 2005. At this moment, Yahel had a functional network.

Mobilization: Yahel became the spokesperson of the Actor Network. In this case connectivity was not the spokesperson as there was little demand. He visited conferences globally to speak about the network and the importance of Broadband Infrastructure in rural areas. It was at the Broadband conference in Berlin, where he met Jim Forster, the co-founder of Airjaldi.

IDENTIFIED PPIS

This case is different from the case of JAWUG as it has long evolved from being a commercial network to a social enterprise. However, just like in the case of

JAWUG, it is not a PPP and can also be termed a PPI. Here the Government contribution is the deregulation of the 802.11 spectrum as well as the provision of low entry barriers to different entities to engage in the provision of ICT services in rural India. The private sector contribution in this case, just like the case of JAWUG is the investment in developing its own infrastructure.

It is important to note that a more concrete PPI, where the public sector would be fully involved in the project, might have been facilitated if bureaucracy did not exist in the South African public sector.

8.2.3 WIRELESS GHANA PROJECT GHANA

Mm The case description is extracted from an interview conducted by a former volunteer of CBLit, however the volunteer decided that reference to the findings should be anonymous. As part of the ethical consideration of this report, we could not bridge that protocol. In this section, the description will comprise of:

- Universal Access Regulation in Ghana
- Overview of rural area
- Overview of the case
- Actor Network Analysis
- Organization and financing of the case
- Identified PPI

UNIVERSAL ACCESS REGULATION IN GHANA

Universal Access regulation in Ghana in recent times has been by facilitating market competition (Williams & Kwofie, 2014). Market competition has been facilitated via market liberalization and market incentives such as the granting of 5 year tax holidays to mobile network operators and tariff reduction on the importation of mobile phones. The Ghanaian Government has also facilitated competition by liberalizing national bandwidth and gateway infrastructure and service delivery. This has led to the reduction in tariff to the end user spending as low as 0.04 Peswa per SMS, 0.1 Peswa per second for on net and off net calls and maximum of 0.7 Peswa per second for international calls on the average (NCA, 2014).

In reaching out to underserved areas, the Ghanaian Government relies on the Universality Fund, the Ghana Investment Fund for Electronic Communications

(GIFEC). They fund rural telephone infrastructure initiatives by awarding subsidies to telcos. They also embark on initiatives aimed at facilitating Universal Access and service. More on GIFEC is explained in Chapter 10.

In the case of the Ghana Wireless Project, there was a regulatory framework in Ghana that captured such initiatives. However, the Universality funds would have funded the initiative, but they know nothing about it.

OVERVIEW OF THE RURAL AREA

Apredie is an old rural town located in the Akuapim North Municipal Council in the Eastern Region of Ghana. It is the last community just by the Akuapem Mountains (ridge). It is an area prone to flooding. Most of the residents are cultivators of maize and palm nuts. These farmers make about 100 Ghana Cedis a day on a good day's sale. The education level of its residents is low. This is not because there are no schools; rather it is a result of rural urban migration. Most of the educated citizens live in other towns, some of the workers that operate businesses here commute from nearby towns. The community is ruled by a traditional ruler. The government has provided social amenities such as electricity and water supply. Some NGOs have provided bore holes to the residents as well as a source of water supply.

It was in this community that a wireless network spanning 20 Km was facilitated by an NGO Community-Based Libraries and Information Technology based in the United States and Ghana. The ANT is used to analyze this case as it provides an insight to the problem by facilitating the bottom -up approach, hence inspiration from the other bottom approaches can be used to discuss the way forward. This will serve as a source of inspiration for future attempts to facilitate the bottom up approach in sub-Saharan Africa.

OVERVIEW OF THE CASE

In 2005 a peace corps member from the United States by the name of John Atkinson was posted to serve in Ghana. He served as a volunteer at the Apirede Resource Centre, a community center owned by the NGO Community-Based Libraries and Information Technology (CBLit). CBLit has offices in the United States and a branch in Ghana. The scope of Operations of CBLit in Ghana was to build community centers and utilize these community centers as libraries as well as ICT resource centers. The ICT resource center took the form of a Telecentre coupled with capacity development activities for the residents of the communities. The aim of CBLit was to bridge the digital divide between children in Ghana's cities and the children in the rural areas. They were also interested in developing the building habits of the rural children. Hence, once the Apredie Community Center was established, it was meant to operate along the lines of their aims and objectives. The center is staffed by volunteers.

John, a mechanical engineer with 3 years experience in programming and interface design arrived at his place of primary assignment. Here he realized that the center in Apirede had a VSAT gateway access, which provided ICT services to the community center. Before arriving in Ghana he already had it in his mind to facilitate the extension of ICT services in Apirede.

He convinced the NGO administrators on the feasibility of the network and the possibility of earning additional revenue to help run the NGO. He carried out some tests that proved successful and he also led the volunteers working as an Information technology staff to aid in selling the idea to people in the rural area. Once they had interest, they facilitated the network. The growth of the network was heavily dependent on the existence and quality of service of the 256 to 516kbps provided to the subscribers. The growth was also dependent on the fact that the cost of access was free while monthly subscription ranged from about 5Ghana Cedis to 50 Ghana Cedis per month.

The decline of the network was a result of the NGO not being willing to expand the capacity of the bandwidth leading to poor Quality of Service as the subscription base grew. Poor Quality of Service led to customers signing off from the service and subscribing to a competing network from Teledata ICT. The village wanted to take over the network and facilitate its expansion, but they were not able to come to terms with the NGO on transfer of equipment. In this case, it was clear that the village structure could be involved in managing a network if they saw the need of it in their daily lives.

ANT ANALYSIS OF THE CASE

Adopting the Michael Callon framework, the retracing of the actors and the events will be described with regards Problematization, Interresement, Enrollment, and Mobilization.

Problematization: John Atkinson developed an initial Obligatory Passage Point with the aid of the technical artifact VSAT, which was that the bandwidth from the VSAT connectivity could be redistributed using a wireless area network which could then serve the Apirede community. To achieve this goal he needed to negotiate with relevant actors that will be needed to make the network a reality. He then set out to identify the actors and their interests. The first sets of actors were the technical actors which included the hardware, software and radio equipment needed to use the Wi-Fi frequency (a very important non-human actor). The second set of actors was the Information Technology (IT) personnel of the Apredie resource center who would help with setting up the equipment and network. The third set of actors was the administrators of the Apirede Resource center and CBLit who had to give the approval for their center to be involved. The fourth sets of the actor were the potential clients and finally the last actor which would either help or mar the network was the mountains.

Interessement: In the bid to interpose or interesse the actors, he first discussed his idea with the IT personnel to persuade them to take up their role in the actor network. As technically oriented actors, John did not have problems convincing them with his technical feasibility of his OPP. This was because the rural Area is located in a mountainous area, the Akuapem ridge, where line of sight for wireless communication would be a challenge. The NGO was also reluctant in adopting the idea because their core competence was not ICT service delivery. He bought the technical equipment for the tests from his personal finance. The successful test convinced the administrators, who in collaboration with the Parent NGO in Accra and the United States provided free omnidirectional antennas and Central Processing Units (CPUS) for the subscribers.

John and the IT personnel also convinced the villagers on the usefulness of the service. Some of these users were already trained and were conversant with telecentres. One would call them "latent IT literates". This implies that they know how to access ICTs, but do not have the means of using ICTs in their daily lives. The villagers only had to pay the monthly subscription fee, which was based on the pay-as-you-go model. The subscriber had software installed in the free CPU that indicated how much traffic he/she consumed and the financial worth of the traffic. Subscribers that liked the idea only had to purchase an Uninterrupted Power Supply (UPS) and directional antennas.

The Bandwidth bought from the Internet Service Provider (ISP) called the Network Computer Systems (NCS) was 1MB and redistributed in the network. Other actors with whom he negotiated to join the network were, the village council, schools, rural banks, Non Governmental organizations and local hotels. The first connectivity was the connection of the NGO Centre to a church on a hill. That hill became a distribution point using a wireless point-to-multi point connection.

Enrollment: The successful tests, convincing of the NGO administration and successful mobilization of demand, with would be subscribers accepting the terms of connectivity led to the facilitation of connectivity. Organizations paid 50 Ghana Cedi per node, with one node free, if they had more than four nodes.

Mobilization: The growth of the network was highly dependent on the existence of connectivity. The Quality of service dropped because the NGO and John did not envisage people in rural areas streaming and downloading. One would say that people had an alternative form of entertainment. Previous knowledge of the ICT services as well as curiosity led to others adopting as well. Hence, one would say that positive externality enabled by connectivity drove the growth of the network. It also brought the network to a decline as well.

Organization and financing of the case: This was a private social enterprise operated by or facilitated by a Non-Governmental Organization. The financing of the infrastructure came from the John Atkinson, The NGO (Via equipment donation) and the clients (via monthly bills).

IDENTIFIED PPI

One would say that the Wireless Ghana Project had some form of Public Private Interplay on a very loose level. The only role of the Government here was the deregulation of the Wi-Fi spectrum, whereas the project in all ramifications was a private initiative (social enterprise). No form of Public Private Partnership was identified here.

CHAPTER 9. GROUNDED THEORY ANALYSIS OF THE PRIMARY CASES

9.0 DEVELOPED COUNTRY CASES

Grounded Theory is adopted to analyze the cases one by one. The purpose for using Grounded Theory is to identify the causal factors that led to the outcome in each of the developed country cases. Effort is also made to identify the actions /interactions that were triggered by the causal factors, to produce the outcome. The expected outcome is same as that of the developing country case, which is the implementation of the infrastructure.

The cases considered in this section were:

- The Hallaryd Broadband Coop in Sweden.
- The Magnolia Road Internet Coop in the United States of America.
- Djurslandsnet in Denmark

9.0.1 HALLARYD BROADBAND COOP SWEDEN

The identified independent variables in the case of the Hallaryd Broadband coop, Sweden, as seen in Appendix G.1.2 (selective coding process 2), were: Mobilization, vital resources, relationship with the private sector and that the municipality took the lead (municipality initiative).

Mobilization: In the case of Hallaryd coop in Sweden, mobilization and the actual co-op formation were two separate events. These events were two key factors that led to the coop formation - among other factors. For mobilization to occur, the municipality idea had to be adopted by the co-ops. From the coding process, the various factors were identified as drivers to the idea adoption. These factors, as extracted from the coding process, are seen in the box 9.1 below, extracted from the selective coding process found in Appendix G 1.3.

For Almhult municipality, “idea transfer” as showcased in Appendix G.1.2 (selective coding process 1), led to the motivation to form the co-ops as mentioned in this report. The reason for the slight difference is as a result of the answers gathered from the municipality and the Hallary coop.

Box 9- 1 The Mobilization Process

The idea transfer from the municipality: This served as a catalyst for discussion.

Municipality responsibility: Knowing what burden the municipality would bear was important.

Perceived usefulness of the technology: The people in Hallaryd had to understand why the new technology and how it would be different from what they had.

Manageable coop responsibility: As the formation of co-ops was not their initiative, their responsibility had to be reasonable or else no one would be interested.

Public funding: This was vital to the co-ops, especially the EU funding, which covered half the cost for the digging and the municipality funding as well. This led to the co-ops being able to raise 200 000 Sek each for the project, which they found reasonable.

Possible telecom scarcity: The elderly and senior citizens saw no need for signing up. However the storm of 2005 and the court ordeal they faced with Telia made them sign up for a more durable telecom infrastructure.

The Emergence of New technology: The co-ops in mobilizing themselves sent out newsletters indicating that by 2020, the present technology would be obsolete, hence now was the time for action.

The Poor QOS for mobile service: Young people in the rural areas were tired of the poor QoS of mobile services; hence they opted for the FTTH. The seniors were not bothered about that.

Coop income: The possibility for the coop to sustain itself via the membership fee, annual EU fund for coops and from Access connectivity fee provided an opportunity for people to come together to facilitate the infrastructure.

Vital Resources: The vital resource they had was a handbook on how to operate a fiber coop as well as knowledge from the municipality. Another vital resource was the ability of the Hallaryd coop to learn from other earlier existing Broadband co-ops. Finally, people in Hallaryd are medium income earners in Sweden, even though they live in rural Almhult. Hence, they could afford to implement the infrastructure.

Municipality initiative: The Hallaryd co-op came into being as a result of the push from the municipality. Hence the municipality led the way; else there might have been no Hallaryd coop. However, as mentioned earlier, other Broadband coops existed in Hallaryd before the municipality got involved.

Relationship with Private sector: The municipality defined the relationship between the co-ops and the private sector. In this way, the private sector could provide their services to the co-ops as an obligation, knowing full well that they will be paid. Here the municipality was the go between. From the municipality point of view, they had a technical resource at an affordable rate.

These factors led to the actual formation of the coop. Hence, the motivation for the people from Hallaryd to form a coop is expressed in the figure below.

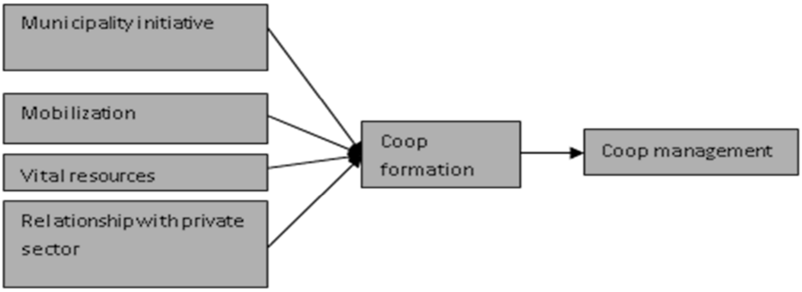


Figure 9- 1 Causal factors leading to Hallaryd coop Broadband Infrastructure implementation

These factors, although seen as causal factors are also moderating variables to a whole other set of causal factors as seen in Appendix G.1.2 (process 2). One of such factors include “the perceived usefulness of the technology”, which led to mobilization before the coop was formed.

However, here there was no search for critical mass and there was no iteration of the process – as will be seen in the case of the developing countries. This was because much of the financial risk was borne by the public sector (the municipality). Secondly, the public sector was the driver of the project. Once the coop management was formed, the coops were ready to implement the digging process as well as partner with the municipality to implement the infrastructure.

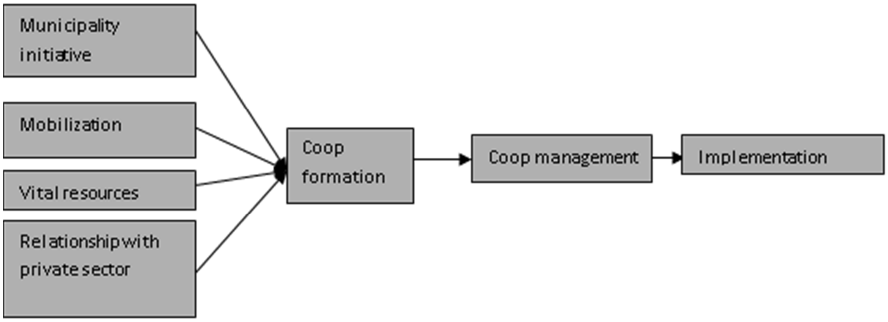


Figure 9- 2 ***Causal and Intervening variables leading to Hallaryd Broadband Coop***

9.0.2 MAGNOLIA ROAD INTERNET COOP USA

For the Magnolia Road Internet Coop, the process was not straight forward as that of the Hallaryd Broadband coop. There was no external body to moderate their effort, hence like the developing country case there were more than one process. They residents of Magnolia road were interested in facilitating Internet connectivity in their area based on the Peak-to-Peak Healthy Community Project (PHPCP) initiative. However, interest in facilitating internet connectivity only occurred after they were inspired by smaller efforts to facilitate internet connectivity by George Watson, a resident of the area in his house, the existence of some form of wireless network in the neighboring connectivity at Sugerloaf, a neighboring community and the arrival of Peaknet, a small Internet Service Provider.

In the first process, the initial enthusiasts consisting of Rob Savoy, Greg Ching and other enthusiasts perceived that the wireless technology (Wi-Fi) could be useful in pushing the PHPCP initiative at Magnolia. They observed tests by George Watson as a means of conceptualizing the usefulness of the technology, gain inspiration as to how they could go about with their solution and also as a search for a potential network solution. This process, in the selective coding process 1 is expressed in the Appendix G.1.3. Once confirming the potential usefulness of the technology as seen in process 1 of Appendix G.1.3, they had to find out if the technology could connect more than one user. The outcome of the findings of this process led to actual tests for the perceived usefulness of the technology. George Watson facilitated the conducting of these tests. This process is identified in the Appendix G.1.3 as process 2. Once they could identify the perceived usefulness of the technology, they began to search for deployment possibilities, and Vital resources (State funding and T1 provider). This is identified as process 3 in the Appendix G.1.3.

Mr Watson's results proved that the vital resources could be afforded for a larger network, if they had either state funding or they were able to mobilize themselves to finance the project. The vital resources were: donations of technical equipment from the volunteers, the donation of the houses of the enthusiasts for tests, George Watson's technical knowledge, the combined human resources of the initial enthusiast, the ability to mobilize new enthusiasts via the yahoo groups, puma mail and puma events. It was at the puma events that the enthusiasts were able to speak about their efforts and in some cases made the tests to coincide with the puma events. Most importantly, they had self-determination as a vital resource. George Watson's exploits in the tests also revealed the fact that the Wi-Fi network could be developed by the enthusiasts.

Trials or mini-implementation was the bridge between one process to the other. The trials did not always produce the desired results, hence repeated trials had to occur till success was achieved. Once success was achieved, then a deployment possibility became visible to the group. Hence, as seen in process 4 of appendix G.1.3. Vital resources and the possibilities of getting the vital resources were vital toward the various trial phases. However, from the identified 4 processes, certain factors served as motivation to conduct some tests. These factors, as explained in process 6 of appendix G.1.3, were extracted from what was perceived by the author of this report to have occurred in the processes. It was the cumulative satisfaction achieved from conducting these tests that led to the desire to implement the infrastructure by the enthusiasts.

The factors are:

- The perceived usefulness of the technology
- The Potential of the network from this technology
- Deployment possibilities
- The existence of vital resources

The existence of vital resources was not necessarily a product of the test, rather it was an asset the enthusiasts had that helped them carry out the test. Hence the factors that led to a testing can be seen in the diagram below is extracted from process 6 of appendix G.1.3

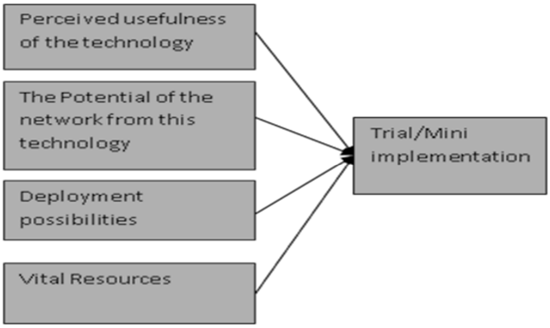


Figure 9- 3 Causal factors leading to Mini-trial (MRIC)

The codes and excerpts from the document granted by magnolia road indicates that, right from the onset, the enthusiasts were driven by these four factors. The iteration only grew in magnitude as they tried extending the test over long distances and not as a means of raising capital.

However, after the initial point-to-point and point-to-multi-point connectivity trials, the enthusiasts and their growing number of followers, decided to do more long distance tests to examine the QoS over long distances. The long distance tests led to mobilizations and the move towards formalizing the organization. The process then evolved were as seen below.

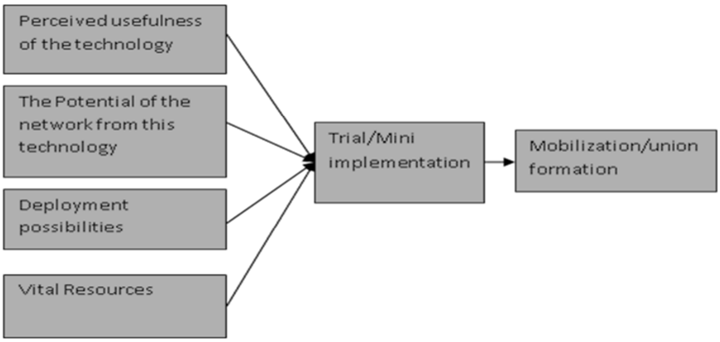


Figure 9- 4 Intervening variables for MRIC

However, quite unlike the developing county cases, the iteration was not aimed at attaining critical mass. This was because the enthusiasts were sure of getting state funding to facilitate a much larger network. Their mobilization of people was only aimed at making sure that people benefit from the network.

It was during the mobilization stage that the founding fathers of the network incorporated the union. It is difficult to say that mobilization led to the formation of the union. The final implementation occurred once the needed long distance tests were successful. Hence the final outcome can be seen in the diagram below.

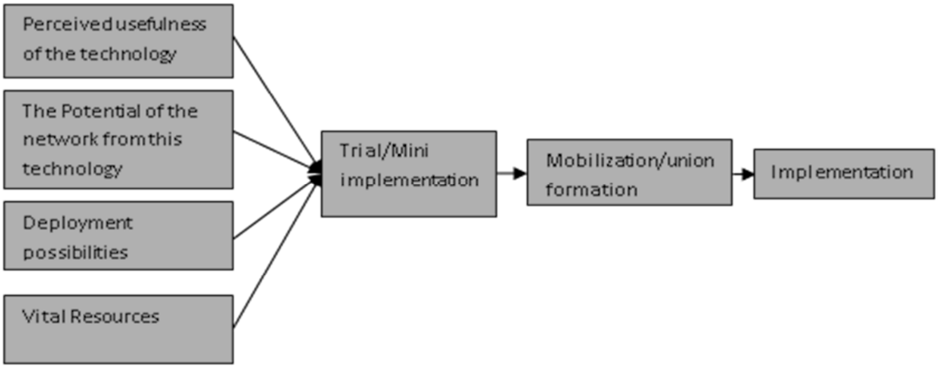


Figure 9- 5 Full implementation processes for MRIC

9.0.3 DJURSLANDSNET DENMARK

Djurslandsnet is an old case as it has evolved into ten different networks. However, it was important to look at the case as it was the foundation of the ten networks. The case of Djurslandsnet is similar to that of the Magnolia Road because, it was a bottom-up approach facilitated by the will of the people. The only similarity it shared with the Hallaryd Coop is the fact that EU funding was involved as well. In the case of Djursland, there was no municipality funding for the project as Denmark considers telecom infrastructure development a prerogative of the market. The unique feature of the Danish case compared to the other 2 is that the idea of the process was initiated by one man, Bjarke Nielsen, and others came on board to help him push it further. Hence it was important to identify his journey in the process. This is evident in the Selective coding process in Appendix G.1.1.

In the process of selective coding, 6 processes were identified as seen in the appendix G.1.1. The first process portrays why Bjarke was useful to the project and why people decided to buy into his idea. He was known to possess innovative competencies and he had influence both as a teacher and a project organizer. The second process identifies the computer solution organization (Bovl) that was organized by Bjarke. It answers the question of what led to this movement and why was Bjarke central to the movement? This bovl movement was a driving vehicle for mobilizing people and that eventually metamorphosed into Djurslandnet. Hence there was potential for the organization of future Djurslandsnet. The second process identifies Bjarke's usefulness towards repairing PCs and the location of the Bovl as driving factors for the formation of the bovl group. The third process identifies how the earlier walkie - talkie network inspired the adoption of wireless networks by Djurslandsnet. The walkie - talkie network provided Bjarke with the vision of low-cost, high speed wireless network. This analogue network did not produce high data rates, rather for Bjarke, he believed that in the future a wireless network would produce such attributes. This process produced the confirmed usefulness of a wireless network for long distance communication. This led to his firm conviction that wireless Broadband is preferable. Here he began a mini-mobilization of members of the bovl group to prepare for the future. In the fourth process, Bjarke received municipality funding to develop a telecenter, this was where he and his team had to learn about fixed and wireless networks. This was a capacity building phase for him and his team of volunteers. The fifth process involved Bjarke and his team searching for help financially and to have a telecom operator build the network. At this point Bjarke and his team were convinced that they would adopt a wireless network for Djursland. They applied for EU funding, but had no money immediately to begin the process. Hence, they searched for external help from the municipality, the Danish business association and from telecom operators to deploy the network. The telecom network operators did not find Djursland commercially viable for a Broadband network, Bjarke and his team could not convince the Danish Business Association of the viability of their plan and the Danish Government policy was that the telecoms market to handle telecom infrastructure development. In the bid to convince the external players for help, Bjarke and his team had collected 625 signatures from different households in Djursland. Hence he had to report the failure to get external help to the people. This sparked self-determination and the people decided to form a union to facilitate the project. This self determination was made possible by the factors identified in process 6, which indicated the existence of technical feasibility and a potential economy needed to facilitate a Broadband coop.

Hence, from the first 5 processes identified in the selective coding process in the appendix, the following factors led to mobilization to form Djurslandsnet. These are *the perceived usefulness of the initiator, the potential for organization by Bovl, the perceived usefulness of a wireless network* (inspired by the walkie talkie network), *capacity building, failure to get external help* and *self-determination*. Technical feasibility of the network and the possibility of an initial self-sustained economy before the arrival of EU funding played a critical role in determining to mobilize them and form a union.

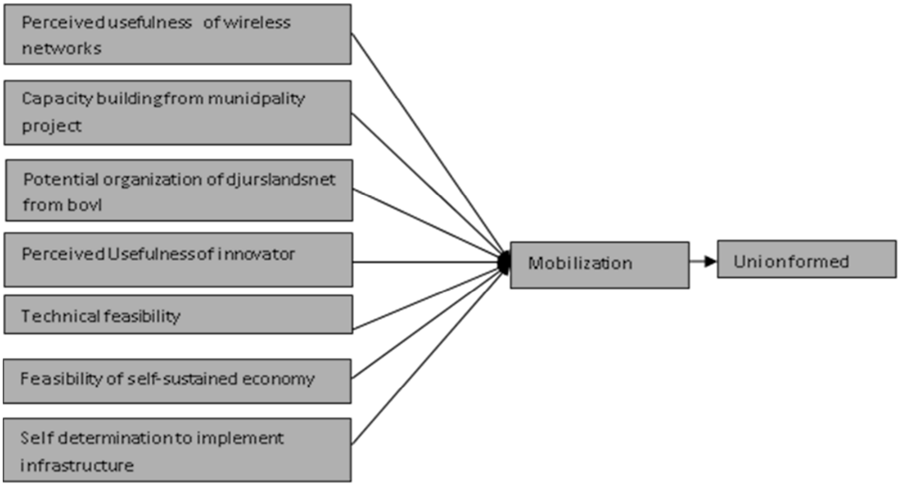


Figure 9- 6 Causal factors for the development of Broadband Infrastructure by Djurslandsnet

Another important factor that got lost in the process, but was very instrumental were vital resources. These resources include attributes identified through the coding process such as *self-determination* (which was visible through the processes), *the potential economy*, *the existing bovl organization*, *personal networks of the people*, *lessons from test runs*, *Bjarke's previous management experience*, *Bjarke's previous educational training*, *intrinsic knowledge of how to configure the network after capacity building*, *natural resources* (number of households, population of Djursland) and the *technical resources*. Hence aside perceived usefulness of technology and technical feasibility, every other factor could be considered as a vital resource that facilitated mobilization. The perceived usefulness of the service did not play a prominent role at this stage as many areas in Djursland then had only fixed line connectivity and no mobile connectivity. Hence, many in rural areas did not see the need for an additional telecom network. Hence Bjarke and his team had to go through the process in order to facilitate high speed low cost Broadband service. The affordability of the service was the key driver for the whole process. Hence the new hypothesis for Djurslandsnet could be reduced to the relationship represented in the figure below.

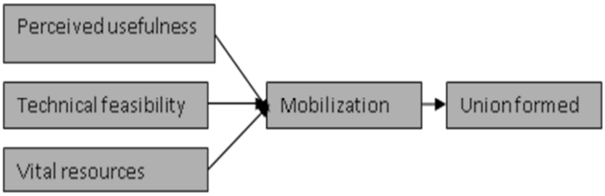


Figure 9- 7Condensed Causal factors and intervening conditions in the development of Broadband Infrastructure by Djurslandsnet

Here there was no iteration and no test before mobilization. Mobilization was accidental. The test occurred during the actual implementation. Implementation, which involved a series of testings and search for deployment possibilities occurred after the formation of the union (coop). Hence the full process is expressed in the diagram below.

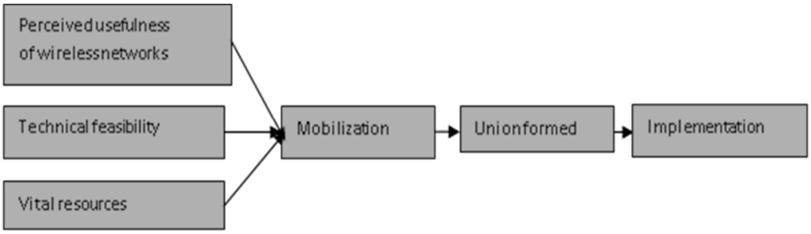


Figure 9- 8 Full implementation processes for Djurslandsnet

9.1 CROSS-CASE ANALYSIS FOR DEVELOPED COUNTRIES

In analyzing across the cases, the effort is made to identify the strong and common causal factors that led to the outcome across the cases. Effort is also made to identify the actions /interactions that were triggered by the causal factors to produce the outcome across the cases. The expected outcome is same as that of the developing country cases, which is the implementation of the infrastructure.

The developed country cases differ from developing country cases because the approach towards implementation differed in each of the developed country cases. Hence, in making a cross case analysis, the emphasis here is not necessarily to focus on the similarities of each case. Rather, it is to identify the important facets of each case and how they logically relate as a whole. The first task here was to find out what were the common causal factors that triggered the trial, mobilization or coop formation. The second task was then to identify the plausible trajectory of events or actions and how they relate to produce the outcome - infrastructure implementation.

9.1.1 HYPOTHETICAL MODEL DEVELOPMENT FOR DEVELOPING COUNTRY CASES

In the Strauss and Corbin (2008) tradition, the first step towards theory development –in the coding for process- is to identify the causes of the events and the resulting events (action/interaction) that produces the central phenomenon. This approach is adopted in this section to build the hypothetical model.

CAUSAL CONDITIONS FOR DEVELOPED COUNTRIES

In identifying the common causal factors, the causal factors of each case in section 9.0 were placed side by side to identify which factors occurred in more than one case. This is reflected in the table below.

Table 9- 1 Common Causal Variables

Common variables	**Fixed Broadband coop**	**Wireless Broadband Coop**	
	Hallaryd coop (Sweden)	Magnolia road (USA)	DjurslandsNet (Denmark)
Vital resources	Vital resources	Vital resources	Vital resources
	mobilization		
	Relationship with private sector		
Perceived usefulness of technology	Municipality initiative	Perceived usefulness of technology	Perceived usefulness of wireless network
	Municipality initiative	The Potential of the network from this technology	Technical feasibility

Deployment possibilities	Deployment possibilities

Williams (2015)

It is important to note that the developed country cases presented here differ. The Swedish case facilitated fixed Broadband infrastructure, while the US and the Danish case facilitated wireless infrastructure. However, in juxtaposing the identified independent variables for each case, one can try to understand what was could be said to have occurred in common to each of the cases. However, there is a clear difference between the Swedish case and the other cases. In the Swedish case, the municipality moderated the process and hence mobilization became a variable as the municipality facilitated the process. Secondly, the municipality also provided a clear relationship with the private sector. In the case of Magnolia road, the final decision to outsource the backhaul infrastructure came after the implementation. In the case of Djurslandsnet, they were not able to sell their idea to the private sector.

However, the similarities that exist here were:

- Every one of them had the vital resources needed for their unique situation. There was the need to test the perceived usefulness of the technology. In the Swedish case, the municipalities after deploying their backbone were able to relay the perceived usefulness of FTTH to the coops. In the case of Djurslandsnet and Magnolia Road Internet coop, their desire to know what the technology could do was vital.

- In each of the cases, possibilities of deploying the technology were vital. In the case of Djurslandsnet and Magnolia Road Internet coop, they had to learn about the technology. Hence it was a learning process for them, as they had not been involved in such a big technical project before. Once they learnt about the technology, they tried out deployment possibilities to see how it would work. In the Swedish case, the municipality had already fashioned this out for the coops, hence they had to follow the municipality blue print.

Based on this comparative matching, the identified independent variables would then be:

- Vital resources
- The perceived usefulness of the technology
- Deployment possibilities of the technology.

The concepts, mobilization and the relationship with the private sector are not considered because this would occur later. Mobilization and relationship with the private sector occur at the same time because during the mobilization phase, an organization can be formed. The organization that is formed could choose to either relate or not relate to the private sector.

INTERACTION/ACTION PROCESSES

Action and interaction in all the cases did include mobilization. However, in the case of Djurslandnet and Magnolia Road Internet Coop, mobilization and trial or mini implementation were crucial actions/interactions. In developing a hypothetical model, it would be logical to identify causal factors that led to mobilization, which then produced trials or mini implementations. Vice versa, the same can be said to be true as well, based on the evidence of the Magnolia road internet coop. This fact produces trial/mini-implementation and mobilization as moderating variables. This is verified by the following synthesis:

- Swedish case (Hallaryd coop): Coop formation and coop management were mediating variables.

- US Case (Magnolia Road Internet Coop): Trial/mini implementation and mobilization/ union formation were mediating variables.

- Danish case (Djurslandsnet): Mobilization and union formation were mediating variables

Hence, which mediating or interactional strategy(s) come first? The mediating variables in the Swedish case, one would say were predetermined. However the mediating variables from the US and Danish cases were products of circumstance. In the US case, this was a group of people whose interest grew as the test produced promising results. In the Danish case, Bjarke's convictions and his initial involvement in earlier projects led him and his group to make up their mind before trying their hands on the big project. However, both have something in common which means that testing did occur. Both also formed unions. In order to create a link, then one has to think back at the causal conditions identified earlier. If "*deployment possibility*" is an independent variable, then it is logical for a deployment possibility to be confirmed before people are mobilized to implement the infrastructure development.

Hence, the moderating variable would be that trial/mini-implementation will lead to Mobilization or union formation, if and only if the initial trial results are positive.

Hence the new hypothetical outlook would then be:

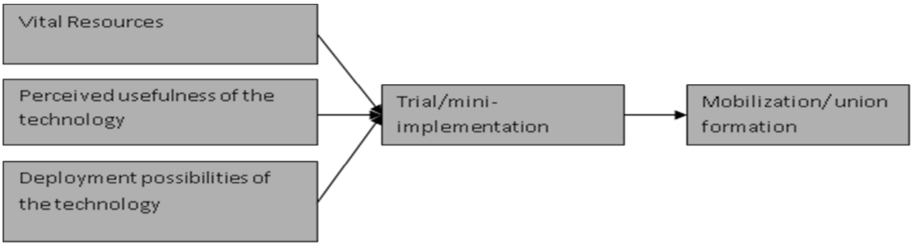


Figure 9- 9 Causal factors for development of Broadband infrastructure via bottom-up initiatives in developing countries

On the other hand, if the innovators are technically minded people or they have outsourced the implementation to the private sector, then the hypothetical outlook for the model will change. Hence the new hypothetical outlook would then be.

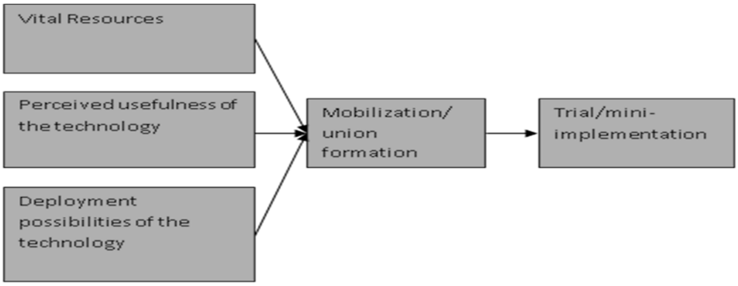


Figure 9- 10 Causal factors and intervening conditions for Broadband development in developing countries via a bottom-up approach

The dynamic placement of the action strategies is based on the fact that the rural dwellers in the developed countries - due to the level of education, societal influence and geographical placement - are more likely to know the usefulness of the service than their developing country counterparts. Hence, once the causal conditions are in place, just like the Djurslandsnet, they would mobilize, form unions and begin the implementation in batches.

The difference between this model at this point and the developing country model is that there was no iteration to achieve critical mass. In the case of Magnolia road, the vital resources utilized came mostly from the volunteers. These volunteers, out of good will, donated their *expertise* free of charge, *bought equipment*, *donated money* and their *houses* etc., to see the project happen. In the case of Djurslandsnet, they already had a *potential economy* with 600 people ready to contribute money for the process to take off. The people in the developed country were *educated*, they had *reasonable income*, they knew what the technology could do and they wanted to be a part of it. Hence, one would say that there was ready demand. Hence, iterations were not necessary.

Outcome of the Process: The central idea for adopting Grounded Theory was to understand the process that led to implementation. In each of the cases, based on the codes extracted from the Grounded Theory process, the processes that led to implementation were identified. Hence, in each of the cases, it was clear that once the coops were formed, full implementation began. Hence, the overall model is presented below.

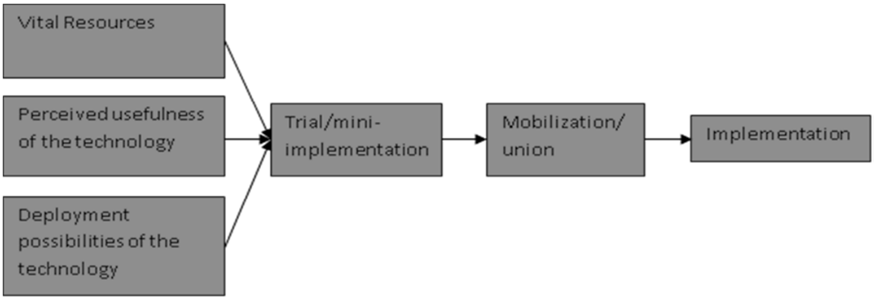


Figure 9- 11 Hypothetical Framework for Developed countries variant 1

It is also clear that the mobilization and coop formation can occur before the trials. The small patches of trial could result in full scale implementation as in the case of Djurslandsnet. This is represented below.

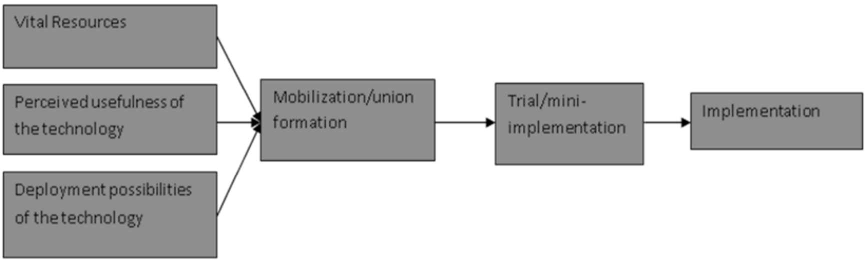


Figure 9- 12 Hypothetical Framework for Developed countries Variant 2

The third scenario which is reflected in the coding process could be that in searching for the deployment possibilities of the technology, trials are conducted there. In that case, the model would be:

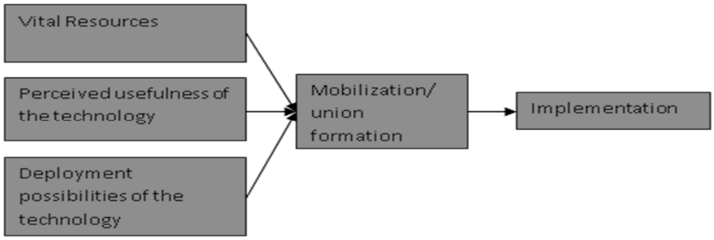


Figure 9- 13 Hypothetical Framework for Developed countries

9.2 DEVELOPING COUNTRY CASES

In section 9.1, there were few comparisons made between the outcomes in that section and this section. This was because they were analyzed together. However, in this section, a full picture of the developing country cases is painted. Analyzing the cases one by one, effort is made to identify the causal factors that led to the outcome in each case. Effort is also made to identify the actions /interactions that were triggered by the causal factors to produce the outcome, which is the implementation of the infrastructure. The developing countries here are The Republic of South Africa, India and Ghana. The cases are the Johannesburg Wireless User Group, The Dharamsala Wireless Network and the Wireless Ghana Project respectively.

Unlike section 9.1, where a summary of the coding process was made, this section provides more details into the coding process. This is because the primary concern of this report is developing countries. Hence, from that context, it is proper to probably repeat some portion of the appendix to explain the process in summary.

9.2.1 JOHANNESBURG WIRELESS USER GROUP SOUTH AFRICA

SUMMARY OF OPEN CODING

The interview conducted with the Chairman of JAWUG provided 78 open codes as seen in Appendix B.2.1. Codes were not extracted from the JAWUG website as in the case of the ANT. This was because; the open coding produced similar outcomes to that of the interview conducted with the chairman. These open codes were concepts or abstracts. The second process was where similar codes were grouped together to form categories. The table below presents the codes (concepts) and the memos of the codes. It was the memo of the codes that led to the naming of the categories. The concepts were identified via line – by - line coding, sentence coding, word and phrase coding.

Table 9- 2 Concepts and Memos from the JAWUG Case

Concept	**Memo**
Initiators	They had the vision of establishing the network for themselves
Platform to play games **platform to collaborate on school assignment**	The initiators understood why they needed the network
Needed cheap network solution	The existing Broadband infrastructure and service was costly
Wireless connectivity	The initiators went for a network solution they could afford to implement
Had use of network	The initiators already knew which network solution they wanted
Technical knowledge **Know potential of Wi-Fi network**	The initiators were computer science students with knowledge of wireless networks
Free spectrum **Affordable technical resources**	The initiators had technical resources they could afford
Comradeship	The initiators were united in their action and they also had friends who wanted to share in the network
Low level of connectivity **Unaffordable existing technology** **low availability of existing technology**	These were the problems experienced by the initiators as well as the others who opted for the connectivity provided by the initiators. This implies unavailability
First test **Initial Wi-fi connection**	At the different stages of growth and expansion, the initiators and the new volunteers embarked on trials to understand the scope of expansion of the network

Wi-fi produced Fast wireless data rates	The initiators experienced download speed as high as 11mbps. This confirmed the usefulness of the wi-fi to meet their needs. This implies connectivity
People of like minds (street neighbours) **People of like minds** **invite their friends and street neighbours**	The neighbours were willing to go along with the idea of being connected without any formal corporation. Hence they had the cooperation spirit
identifies efficiency of the network	The efficiency of the network was evident at every stage of expansion leading to greater connectivity
Expanded the network **Network growth by word of mouth**	The efficiency of the network led to the informal verbal advertisement of the network leading to greater need for connectivity and eventual connectivity
Need for affordable network	The emergence of the Wi-fi network was seen as an alternative of an affordable network.
need to Interconnected network with other networks	The growth and emergence of sister networks led to the need for interconnectivity
Management formation to formalize organization **Management election** **Management organization** **Management working group** **Decentralized management in each area** **JAWUG is formed** **Initial High adoption**	Critical mass was amassed based on the emergence of merging of sister networks and the growth of the clientele. This led to the need to form an organization that will manage the network. JAWUG is born

It is an urban networ	
Volunteer oriented **No volunteer remuneration** **Membership sign-up fee** **Membership control** **Annual membership subscription**	The new group decided on the specifics of the organization
Traffic routing to other networks **No interconnection fee** **ISPs provide free bandwidth**	The need arises for JAWUG to interconnect with other wireless networks as they are not able to connect with PSTN, based on the restriction from South African Government. This implies interconnectivity challenge. ISPs provide free bandwidth
Similar networks exist **The need to interconnect to other wifi networks**	Competing networks exist
Advice from technocrats (ISPs etc.)	Source for technical knowledge on how to interconnect. This is technical consultancy
Few streams of income **Incentive from hardware suppliers** **Donation from private sources** **No loans**	The organization decided on the income structure of the organization
No public assistance **Attempt to reach out to government** **Discouraged by bureaucracy** **Decided against government help**	No public support. Failed attempt at PPI or PPP

so far no support from telcos **Transit with telcos not allowed** **Government regulation does not support transit with telcos**	Regulatory challenges led to interconnectivity challenges and also limited public support
No accountability issues **Disagreement do occur** **Management of dispute resolution** **They work together** **Problem resolution**	JAWUG has been able to weather internal management crises.
The process is expensive **High cost of upgrades**	On hindsight coop formation and management is expensive. This implies high expenditure.
Cheap mobile Broadband competing with the network **Inconsistent volunteers** **Project at peak** **Mobile Broadband provides better data rates**	Organizational threats and the completion from the mobile Broadband operators are the current challenges
WiMAX unaffordable **Wi-Fi preferred**	Wifi chosen because WiMAX was unaffordable
Rural subscription not successful **Network extended to rural areas** **Roll out to rural area is slow**	Failed attempt to deploy in rural Johannesburg due to low adoption
Cost, education, technical knowhow	Inhibitions to Broadband adoption in rural

lacking in rural areas **Broadband, not a priority here**	Johannesburg
Rural network a good initiative	Opinion
Support from public sector needed for rural **Community networks can work**	Incentive needed for rural penetration of wireless Broadband
Late organization of coop **Delayed initial strategy for development**	Regret for late organization of coop

Based on the similarities in the memo, the concepts (open codes) were regrouped to produce sub-categories. The table above, represents the open coding and memoing process used during the data gathering phase. Its application in the process can be traced in appendix F.2.1. In the process of open coding, there was a realization that the initiators already had an idea about this technology and the services (gaming) the wireless Broadband can deliver. Hence, based on this "*perceived usefulness*", they were motivated to carry out this test. This is why perceived usefulness of the service is added as one of the open codes.

SUMMARY OF AXIAL CODING

The emerging axial codes (categorized open codes), as seen in appendix F.2.1 were: "*Actual infrastructure development*", "*Intention to develop infrastructure*", "*potential for growth*", "*perceived usefulness of technology*", "*perceived usefulness of service*", "*confirmed usefulness of technology*", "*Actual usefulness*", "*Vital Resources for technical test*", "*confirmed usefulness of service*", "*trial/mini implementation*", "*existing service scarcity*", "*growth*", "*Potential vital resource*", "*threats*", "*problem with existing technology*".

In order to understand the process and the interactions that lead to the linking of these categories, the search for process had to be done diagrammatically during the selective coding process. The diagrams can be seen in appendix G.2.1.

Three phases were identified in the case of JAWUG. The phases were identified with ANT. However, in these three phases, two processes took place as seen in appendix G.2.1. The first process was the test for the feasibility of the technology and the second test was the test for service usefulness.

While analyzing the emerging axial codes listed above, the codes that denoted action and interaction were the Actual infrastructure development and Trial/mini-implementation. The codes that demoted consequences of the actions were the Confirmed usefulness of service and growth. The next step was to identify how these conditions combine to create the context or causal conditions?

In identifying, the causal conditions, two events were identified. The two events occurred as the innovators pondered on how to deploy the network and what network to deploy. The first event was the test of the technical feasibility of the chosen technology. The second test was the test for service usefulness. Hence, as seen in appendix G.2.1, the causal conditions for both events are identified

Test for technology feasibility: Two causal factors emerged from this process. At this point. Trial/mini-implementation becomes a moderating variable. This is because the conditions now denote independent variables. In the first process, the causal conditions for technology feasibility were:

- Perceived usefulness of technology
- Vital resources

This is evident in appendix G.2.1, process 1.. The explanation of this identifies causal conditions is as follows.

At the initial stage, the initiators had perceived the usefulness of the technology. They had vital resources such as *knowledge* of how to set up the network, *free Wi-Fi spectrum,* and they could afford the technical equipment needed for *their pocket money*. They carried out a trial and the result was the confirmation of technology feasibility. At the second stage, expansion was also possible because the enlarged group could perceive the usefulness of the technology based on what they could see from the initiators. They had the initiators as the source of implementation and *knowledge* and *the wireless equipment were affordable*. Hence, they had vital resources. The initiators carried out the test and there was a confirmation of the feasibility of the technology on a larger scale. In the third phase the enlarged group could perceive the usefulness of the technology for long distance communication. The group did comprise of volunteers and they could raise money, they had free bandwidth from ISPs, they now had technical and human resources. These are vital resources they could muster. The existence of the perceived usefulness of the technology and the vital resources led to a trial which confirmed the feasibility of the technology.

The test for service usefulness: Two causal factors were also identified in this process. These were:

- Confirmed usefulness of technology
- Perceived usefulness of service

This is evident in appendix G.2.1, process 2. Here as seen in the three phases of appendix G.2.1, once the technological feasibility is confirmed, the next thing was to test, the test the perceived usefulness of the service. The service test is performed on the network. Hence the conditions, perceived usefulness of service and confirmed usefulness of technology are tested. This produces the earlier mentioned consequence of “confirmed usefulness of service.”

The third phase is implicit. While re-reading through the interviews, it was evident that the tests led to a new consequence that led to some form of iteration. This consequence was the “Intention to develop infrastructure”.

SELECTIVE CODING PROCESS

In merging the three phases, which accidentally occurred sequentially till critical mass was achieved, the emerging action was the actual infrastructure development. This occured in these three phases. This development incorporates the trial as well. However the conditions that led to the action were:

- Scarcity of existing service and technology
- Confirmed usefulness of the technology
- Confirmed usefulness of service
- The availability of vital resources.

These variables, as seen in the figure below, were enough to stimulate the “intention to develop infrastructure” in the case just studied. This intention is considered a pre-consequence of the conditions. This is because there could also be the possibility of these variables existing but no one would be willing to develop the infrastructure. Hence, the intention to develop leads to the development of the infrastructure leading to a consequence. The consequence here is one of the codes, identified via axial coding named “Actual usefulness”. The actual usefulness is the fact that the user is using the service for more than what they had perceived.

Hence, based on this line of thought, the selective coding as seen in the appendix G.2.1 holds.

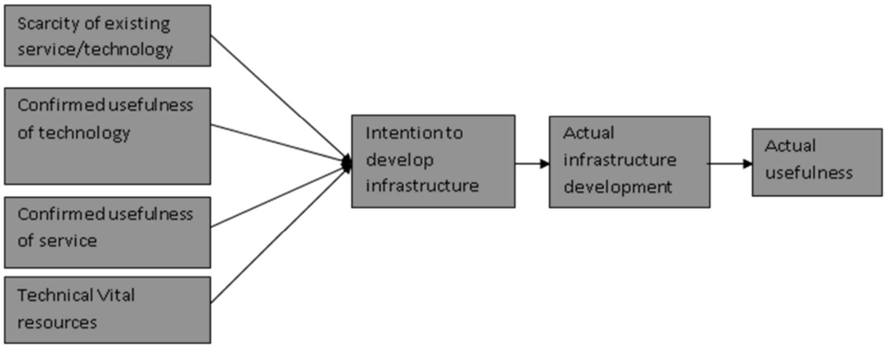


Figure 9- 14 ***Hypothetical Framework for JAWUG***

The selective coding outcome has some similarities with Davis (1985), Technology Acceptance Model (TAM). The model explains that user motivation to adopt a technology is affected by the perceived usefulness of the technology and the perceived ease of use of the technology (Davis, 1985). If these causal factors exist, then the attitude towards using the system is influenced. If the perceived usefulness and the perceived ease of use of the system is positive, then the attitude to adopt the system will be positive, leading to the actual usage of the system. It is important to note that TAM was not considered when theorizing the JAWUG implementation process. It was the coincidental outcome that led to the comparison.

The similarity lies in the fact that confirmed usefulness of the technology, the confirmed usefulness of the service could be equated to TAMs “Perceived ease of use”. Scarcity of existing service and technology could be equated to “perceived usefulness”. The intention to develop infrastructure can be equated to TAMs Attitude towards using.

The difference lies in the fact that TAM deals with service adoption, while the JAWUG framework deals with the intention to develop telecom infrastructure. TAM’s actual system use is different from JAWUGs Actual usefulness. This is because although there was confirmed the usefulness of the network, the actual usefulness of the infrastructure is determined by the Quality of Service provided by the infrastructure to the end user and not what the user can do with the technology.

Hence this framework, although similar to TAM, is different from TAM and not an extension of TAM.

9.2.2 DHARAMSALA WIRELESS NETWORK (AIRJALDI) INDIA

In the case of Dharamsala, the Grounded Theory analyses was carried out in two phases. The first phase was the pre-commercialization phase and the second being the post-commercialization phase. The pre-commercialization phase was extracted based on videos sent by Yahel Ben David, the founder of Airjaldi, the owners of the Dharamsala wireless network and other rural wireless networks-owned by AirJaldi. The video was transcribed and coded. The content of the video was a comprehensive account of how Yahel became involved in developing the Dharamsala network in India. The second phase was extracted from the interview conducted as a follow up with Jim Forster, the chairman and co-founder of Airjaldi.

SUMMARY OF OPEN CODING FOR THE PRE-COMMERCIALIZATION PHASE

The transcribed video produced 18 relevant codes. These codes were few because his presentation was for 20 minutes. He made the presentation at the TEDx talks in 2011. The concepts extracted from the talk were as seen in the table below

Table 9- 3 Sample Concepts and Memos from the Airjaldi case

Concepts (open codes)	Memo
NGOs have need of ICT connectivity to enable information sharing	This denotes the demand pull for Internet connectivity by the NGOs
NGO VSAT	A vital resource
Yahel goes to live in India	The NGOs identify and recruit technical expertise
Yahel opts for wireless connectivity	Yahel decides on which Broadband solution to adopt
NGOs contact Yahel in the US	The NGOs identify and recruit technical expertise. This could also imply recruiting help, hence an NGO resource
Yahel commits his personal resources to develop connectivity	Yahel's passion for wireless networks leads him to commit his personal resources to see the success of the project
Yahel adopts his previous knowledge of setting up	Yahel already has experience in setting up wireless networks, hence he has technical

networks to facilitate connectivity	knowledge
Yahel has passion for rural connectivity	Yahel's voluntary work is filled by personal interest and passion for connectivity
Yahel tests different wireless networks	Once he got his equipments, he decides to try out his ideas by testing a few vantage points in the bid to building a network
Yahel tries international calls with his network	Here Yahel is confirming if his small network works and if the service will be useful to the users
Yahel begins connecting the NGOS	The test is successful, hence he decides to connect the institutions
In 2005 India deregulates Wi-Fi spectrum	This is a later public incentive, which was not aimed at Yahels network, but the Indian Broadband ecosystem in general
Connectivity is extended to other users and institutions	Yahel decides to extend the network to few other institutions in Dharamsala
Yahel presents Indian case at a conference in Europe	Yahel showcases the successful network at a conference in Europe
The next conference is slated for India	The success story leads to interest in the network
Jim foster is one of the organizers of the conference	Financiers became interested in the case
Yahel, Jim, Michael begins planning to turn the community initiative into a social enterprise	Planning to commercialize the Non-profit organization
They chose rural areas as the target area	The area of commercial interest is realized

The reflection of the memos led to the further refining of concepts as seen in the appendix E.2.2. The emerging axial codes were "*demand*", "*recruitment of technical expertise*", "*perceived usefulness of the technology to the innovator*", "*NGO's vital resource*", "*Innovator's Vital resources*", "*Trial*", "*Confirmed perceived usefulness of technology*", "first phase of connectivity", "*indirect public* *incentive*", "*network expansion*", "*knowledge dissemination*", "*gathering of the core team*", "*Incentive to commercialize*" and "*area of commercial interest*".

SUMMARY OF AXIAL CODING FOR THE PRE - COMMERCIALIZATION PHASE

Two processes were identified here as seen in the appendix G.2.2. The first process was the NGOs quest for connectivity and the second process was Yahels attempt to find technological solutions. Pondering on the emerging refined codes, it was clear that Yahel was in control of the second process and the NGOs were indirectly in-charge of the first process. Hence the action and interaction strategies here had to be traced from the action surrounding the NGO and Yahel.

The codes that denoted action and interaction from both processes as seen in appendix G.2.2 were the *"Recruitment of technical expertise"*, *"Trial of technology solutions"*, *"First phase of connectivity"* and "*Expansion of the network"*. The first process as seen in appendix G.2.2 did not produce a consequence that was strong to become a causal factor in the final analysis. However, in the second process, the identified consequences of the action were the "*Confirmed perceived usefulness of technology*" as seen in appendix G.2.2.

Conditions that combine to create the context

In order to explain the how the saturated codes were produced, in the axial coding process, it is important to explain how the 2 processes occurred.

Process 1

The first action/interaction identified was the recruitment of technical expertise. Here the NGOs via Yahel's friend recruited Yahel's help. The conditions that led to this process were the "*scarcity of telecom network connectivity*", which implied Demand from the NGO. The extent of the scarcity is explained with ANT. The second condition was the existence of *human resource* in the person of Yahel whom they could recruit. Secondly, one of the NGOs had internet connectivity via VSAT, by which Yahel could begin with. Hence, Yahel became a vital resource for the NGOs. Hence the conditions for recruitment here were:

- Demand for the Broadband Service
- NGO's Vital resources

These conditions, as seen in the Appendix G.2.2, process 1, influenced the recruitment of technical expertise. This resulted in a code not found in the coding process. The resulting code emerged from a memo "search for internet connectivity." This became a code. The code as seen in the appendix G.2.2, process 1 is the 'search for connectivity', solution. The moderator of this process is the NGO.

Process 2

The second process is distinct from the first process as it is moderated by Yahel. In inspecting the emerging codes from the open coding process (appendix E 2.2) as well as listening to the video over and over again, It was evident that Yahel was given free hands to facilitate the connectivity the NGOs and the people of Dharamsala were in need of. Hence, the search for a connectivity solution did not become a condition for Yahel. He had previous experience with wireless technologies; he had the personal resources to facilitate this technology. This is because he sold his shares in his company in the US and moved his family to India for this project. This he did because he had a passion for Broadband internet development in rural areas. Hence "*personal resources*", "*knowledge*" (technical) and "*personal interest*" became his vital resources. He did combine his vital resources and his perceived usefulness of the technology to carry out an action. The action here is the trial of the wireless technology; this is one of the actions mentioned earlier. Once he got his desired test, he achieved the confirmed usefulness of the technology in Dharamsala.

This explanation, explains process two in appendix G.2.2. Hence the causal conditions for the second process were.

- Perceived usefulness of technology
- Vital resources of the innovator

Yahels process was iterative as identified in the talk transcribed in appendix E.2.2. Here, Yahel says "*I then start searching for solutions to connect the organization,*"

SUMMARY OF SELECTIVE CODING PROCESS

In the bid to abstract a model that describes the whole process, the first process was to identify the conditions that were relevant to the whole process. In the NGO's attempt to search for connectivity the condition that led to their action was the *scarcity in internet connectivity*, which is coded as "*demand from NGOs*" in this process. If the NGO had the vital resources, technical or otherwise, to facilitate Broadband infrastructure development, they would not need Yahel. They would go ahead to implement the infrastructure. Hence the action, *recruitment of technical expertise* is not a strong variable as a group or individual can do without it.

In the second process, the purpose of the action, *trial of technology solutions*, by Yahel was to find out how useful the technology he had in mind would meet the needs at Dharamsala. It was this confirmed usefulness that becomes the condition for actual implementation. On the other hand, if Yahel had no idea of how to facilitate this technology, he would need to acquire the vital resources needed to do so. Hence, vital resources become another condition.

Hence, for the selective coding, vital resources, demand and confirmed the usefulness of the technology were the major conditions for facilitating the "*first phase of connectivity*" as seen in appendix G.2.2 (Theoretical outcome). In listening to the video again, it was evident that once Yahel identified the technology and how to implement it, he extended the network even to institutions that he thought would desire connectivity. This implies expansion of the network. This is represented in the figure below, extracted from appendix G.2.2 (Theoretical outcome).

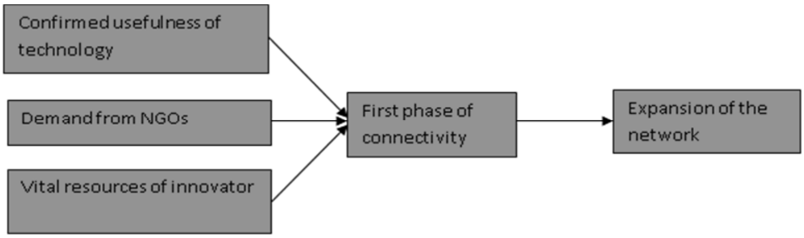


Figure 9- 15 ***Hypothetical Framework for the pre-commercialization phase of Airjaldi***

This is the hypothetical model for the initial implementation of the pre-commercialized Dharamsala network.

Transition to Commercial Entity: The selective coding for the pre-commercialized phase of Air Jaldi's development produced a consequence. This consequence was *the commercial potential of the network*. This became a condition for an interaction between investors on "*the incentive to explore commercialization*" as seen in appendix G.2.3. However, in reflecting on some of the codes derived from the axial coding done earlier in this process, it was evident that the investors got to know about the Dharamsala network from Yahel's presentation at a Broadband conference in Europe. The representative code here was "*knowledge dissemination about the network*". The market entry barriers were low in India. The representative code here was "*indirect public incentive*". The presence of some form of demand in Dharamsala meant that some commercialization could occur. The representative code here was "*Area of commercial interest*". The incentive to explore commercialization was an event that prompted several meetings. Hence, as expressed in AppendixG.2.3, the conditions for the occurrence of these events were:

- Knowledge dissemination about the network.
- Commercial potential of the network
- Indirect public incentive
- Area of commercial interest (i.e Dharamsala)

The incentive to explore did not just lead to implementation. The financiers decided to adopt a market feasibility process to know if it would be viable to invest in the network.

SUMMARY OF CODING FOR COMMERCIALIZATION PHASE

70 codes were derived when coding the interview with the chairman and co-founder of Airjaldi. The Dharamsala network became Airjaldi when it was commercialized. The coding process produced a category set with 2 sub-categories. The codes of the main categories (axial codes) included "*Business modeling*", "*Implementation process*", "*vital resources*", "*trial*", "*confirmed usefulness*", "*Advertisement*", "*Demand assessment*", "*Supply Assessment*", "*actual, growth*". These were the saturated codes.

In sorting the selective codes, the reflection process indicated that quite unlike other cases, this was a more planned process as things were done step by step. The actions and interactions occurred at the points of the Trial and the points of the implementation process. The moderating condition between the trial and actual implementation was once the tests proved that on a commercial level, they could expand the network. So the question now was, *what were the conditions that led to the trial*? One would have expected an expansion of the network as it existed already. However, the investors were already armed with the incentive to explore commercialization. They had the vital resources, which in this case were, *external human resources*, *relevant knowledge*, *network resources*, *bandwidth source* and *economic sustainability* (financial resources). They had positive demand and supply assessment result. Finally, based on the market opportunity (demand and supply), they were able to fashion out a business model.

Hence the conditions for trial were:

- Vital resources
- Demand assessment
- Supply assessment

- Business modeling
- Incentive to explore.

Hence the model for the commercialized network as seen in the appendix G.2.3 is represented below.

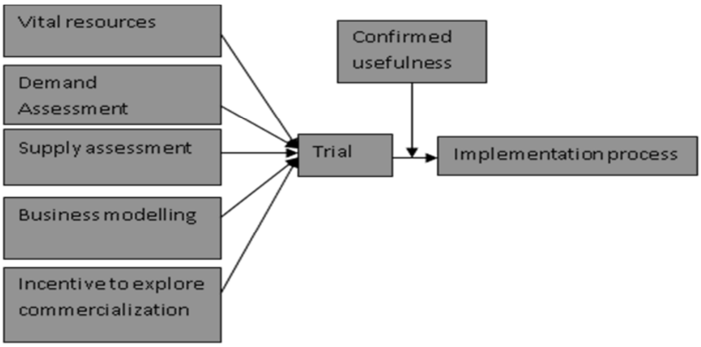


Figure 9- 16 ***Hypothetical model for the post-commercialization phase***

9.2.3 WIRELESS GHANA PROJECT GHANA

The interview with the anonymous person from the Wireless Ghana Group produces 90 open codes. This is represented in appendix E.2.4. The axial coding process produced 2 sub-categories and coding saturation occurred under the main category. The main category codes as seen in the appendix F.2.4 were: "*Initiator characteristics*", "*confirmed usefulness*", "*lead actor* (innovator)", "*management*", "*ICT agenda of NGO*", "*Vital resources*", "*purpose setting*", "*perceived usefulness*", "*innovation*", "*consumer interest*", "*Market assessment*", "*market facilitation*", "*user adoption*", "*Emergent competition*", "*Death of competition*", "*Decline*", "*Actual user need*", "*Initial NGO reluctance*", "*Trial*", "*management persuasion*", "*scarcity*", "*Potential external support*", "*potential organizer*" and "*unsustainability*".

A reflection of the emergent axial codes coupled and the interviews produce 3 events as seen in appendix E.2.4.

<u>PROCESS 1: PERSUATION OF THE NGO MANAGEMENT</u>

Process 1 was the persuasion of the NGO management. The action in the first event was John's personal test, try to convince the NGO administrators that his idea of extending Broadband connectivity was possible. The action here is dubbed *"trial."*

The consequence of the trial was to confirm the usefulness of the technology to the NGO administration. Hence the emerging code which is not part of the initial axial codes, but a result of the reflection on the process was "*confirmed usefulness*."

The causal conditions for the trial were:

Individual initiative: John learnt about the ICT need of the Apredie community in the Eastern Region of Ghana. He also knew about the VSAT resource owned by the NGO. Hence, based on this knowledge, he was able to take the initiative towards facilitating the Broadband network. This emerging code was not captured in the open coding process as "*Individual initiative",* rather it was captured as "*personal vision*" and "*initiator personal interest".* Personal vision and initiator personal interests are open codes grouped under initiator characteristics as seen in appendix E.2.4.

Initiator characteristics: In the open coding process as seen in the appendix F.2.4, the emergent open codes grouped under initiator characteristics were:

1. **Personal vision**: John already visualized what he would do

2. **Ability to mobilize:** Before trying to persuade the NGO administration, he was able to mobilize the IT personnel of the NGO to his vision. They helped in the trial

3. **Initiator personal interest:** Peace corp. members from the United States are advised to facilitate projects in areas where they serve. John found this project to be laudable in Ghana.

4. **External Initiator:** He, John was not a core staff of the NGO. Hence the idea was an external idea from this point of view.

5. **Ability to persuade:** This was an important characteristic of John as he had to persuade the NGO and their personnel to see the possibility of extending Broadband ICT via VSAT to the people of the community

Vital resources: The vital resources here were a combination of the NGO asset which was the VSAT that provided gateway connectivity- hence a technical resource and John's knowledge about setting up the wireless network and his technical and financial resources.

The existence of these three causal conditions led to the trial aimed at proving John's concept. Initially people in the community had to visit the Apredie Resource Centre, the NGO, to access ICT services. His proof of concept opened the door to people accessing the service at home and paying for it.

In the intermediate event between process one and process 2 were conceptual. This is seen in appendix G.2.4 process 1 . The diagram from the appendix G.2.4 is presented below.

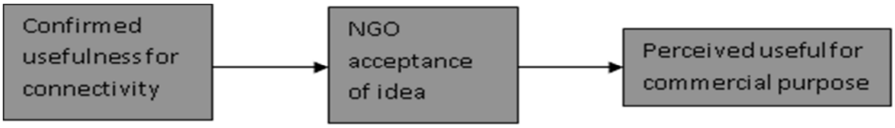


Figure 9- 17 ***Process 1***

The line of thought here is that once the NGO administration could see the actual connectivity take place, they accepted the idea and could now perceive the commercial usefulness of the VSAT terminal. The successful test took place between the NGO office and a church on a hill.

PROCESS 2: SEARCH FOR SUSTAINABILITY

The central interaction process here was the planning by John and the NGO. This was identified in the coding process as "*purpose setting*". The consequence of this process is the intention to develop the infrastructure. Hence the new code name here is the "*intention to develop*." The NGO wanted to be sure they had a full proof plan before attempting to venture into the process of implementing the infrastructure. Johns was given a free hand to facilitate the planning process.

The causal conditions for planning here as seen in the appendix G.2.4 process 2 were:

The perceived Usefulness of the technology for commercial purpose: This is identified as perceived usefulness for commercial purpose. This was the end result of the first process explained earlier.

The ICT agenda of NGO: The NGO was not an ICT NGO, rather it was an NGO aimed at facilitating library materials, both online and offline to enhance the reading culture of the residents of Apredie. The NGO was resident in a school and serving seven other schools in the community. However, the existence of the VSAT infrastructure led the NGO to also operate a telecenter as a means of facilitating ICT capacity building. It was on this premise that the NGO saw the extension of remote connectivity to be of benefit to the NGO.

Vital resources: The NGO had human resources in terms of John and his team, they had technical resources in terms of the VSAT and they also had the financial resources to purchase CPUs for the new clients. The finance came from the parent NGO in the US and Accra. These resources are coded as operational resources in appendix E. 2.4.

Market assessment: John and his team had to carry out sampling surveys to understand the demand dynamics as well as develop a business model to facilitate the process.

The intention to develop, was the answer identified in the process. In the reflection process, for the second process, the query was, why were they planning? However, once the planning stage was completed, this led to the third stage. Another thought that came to mind was, they were trying to find out if the idea could be sustainable.

PROCESS 3 - ACTION/INTERACTIONS LEADING TO IMPLEMENTATION

The central action in the third process is the actual implementation. However the intervening variables here are other actions/interactions which include the trial and the market facilitation.

Trial: At the trial phase, John and his team after devising means of sustaining the network to conduct more trials. In areas where the trials were successful, they mobilize the clients in these areas. Mobilization here occurs in the form of market facilitation.

Market facilitation: The market facilitation occurred in the form of Demand facilitation and demand soliciting, sub-categories as seen in appendix F.2.4.

- **Demand facilitation:** Demand facilitation occurred in the form of capacity building and provision of incentives to the end users. The capacity building was facilitated by the United Nations Development Program (UNDP) and the NGO respectively. These initiatives were not necessarily aimed at developing capacity building for the usage of the new ICT infrastructure. It was coincidental, but was a factor towards capacity building. The incentives provided were: free access connectivity, free Central Processing Units (CPU) provided by the CBLIT, the parent organization of the NGO.

- **Demand Soliciting:** Demand soliciting was facilitated by door to door "*evangelism*" on the service to be provided and the benefits of the service. Interest was also gathered by speaking to those who came to the NGO's ICT center to access their emails or carry out online activities. In this manner clients were mobilized to accept connectivity.

- **Implementation:** Successful market facilitation led to the connectivity and operational management of the infrastructure. There was a separation in management. John and his team led the infrastructure management bit of the project, while the NGO led the overall operational management which included financial management.

CAUSAL CONDITIONS LEADING TO ACTIONS/INTERACTIONS

The critical action here was the trial. This is because the failure of the test trials would not encourage market facilitation to take place. The underlying factors for the trial were:

Sustainability: The sustainability potential of the idea for the NGO as mentioned earlier.

Vital Resources: In the first two processes the NGO administration realized that they had the vital resources to facilitate the wireless Broadband infrastructure development.

Scarcity: Most importantly, although the NGO had the intention to supply, if the mobile network services by then were not poor and mobile internet non-existent, they would not have opted for this project. The reason scarcity was not mentioned during the sustainability process was because it was not reflected as a thought in the process. However, in thinking through the interview, scarcity became a plausible factor.

Hence the implementation process for the implementation of the Wireless Ghana Project can be seen below.

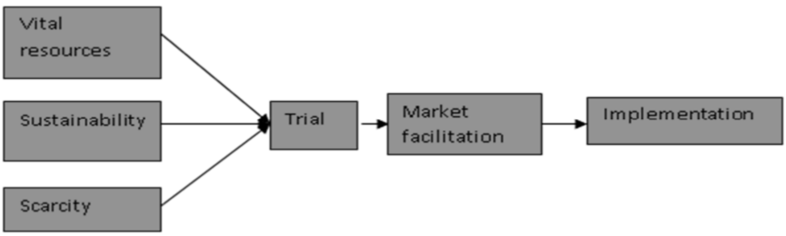


Figure 9- 18 Implementation process of the Wireless Ghana Broadband project

One would say that the third process led to coding saturation.

9.3 CROSS-CASE ANALYSIS FOR DEVELOPING COUNTRIES

In analyzing a cross- case, effort is made to identify the strong and common causal factors that led to the outcome across the cases. Effort is also made to identify the actions /interactions that were triggered by the causal factors to produce the outcome across the cases.

In cross analyzing the infrastructure development in the cases studied, an effort was made to reflect on the codes and processes as a way of identifying the central phenomenon. Aside identifying the central phenomena, a hypothetical, theoretical model was extracted to explain the process of Broadband infrastructure development from the bottom up approach by co-ops and social enterprises.

The central phenomenon here is "*implementation*" of Broadband infrastructure. What is the process? As mentioned in the introductory part of this report, the aim of this report is not to develop a theory or models. However, Grounded Theory is aimed at developing models, hence the model development. However, the essence of the model in this report is to identify the factors that led to Broadband infrastructure development in the cases studied.

The starting point towards theorizing here was to understand, the common factors in each case that led the innovators or organizations to develop the infrastructure. The second part of the exercise was to understand the common action/interactions that actually lead to development. Hence the intention to develop became a pivot for the modeling. The reason for adopting this concept of intention to develop was because in each of the developing country cases studied, aside that of Wireless Ghana; large scale infrastructure development was an afterthought. In the case of wireless Ghana, the innovator was external personnel. Hence, what led to that after thought that triggered the process?

In this section, the actions identified that were triggered by the intention to develop were, trial (experimentation/mini-implementation), and mobilization is discussed. These actions resulted in the actual implementation. The identified causal conditions leading to the "*Intention to develop*" were the existence of vital resources, the usefulness of technology, the usefulness of the service and the accepted user need. This section explains how these variables (Causal and intervening) were extracted, how they relate and how it resulted in the implementation.

9.3.1 CAUSAL FACTORS LEADING TO THE INTENTION TO DEVELOP BROADBAND INFRASTRUCTURE FOR EACH CASE

The identification of causalities that led to the "*intention to develop*" in the cross-analysis was based on the identification of similar patterns of actions. In this section, how these patterns identified so far, were matched is explained, case by case.

CASE - JOHANNESBURG WIRELESS USER GROUP (SOUTH AFRICA)

The South African case evolved in three phases as seen in the table below.

Table 9- 4 Evolution and Causal Conditions of the JAWUG case

JAWUG

Category	**Phase 1**	**Phase 2**	**Phase 3**	**outcome**
Usefulness	Perceived usefulness of technology	They knew that Broadband infrastructure will facilitate efficient playing games online	The enlarged group could see the effect of the first test, hence the usefulness of the technology	Confirmed usefulness of technology
	Existing service need	They already knew the service they needed on the network	They had varied needs	Confirmed usefulness of service
Scarcity of existing service/technology	Existing Broadband was unaffordable with poor QOS	Existing Broadband was unaffordable with poor QOS	Existing Broadband was unaffordable with poor QOS	Scarcity of existing service/technology

Resource	Intrinsic knowledge about the network,	Intrinsic knowledge of networking	Intrinsic knowledge	Vital resources
	Self determination	Self determination	Self determination	
	Infrastructure equipment affordability	Infrastructure equipment affordability	Infrastructure equipment affordability	
		Technical consultancy	Technical consultancy	
	Free resource (spectrum)	Free resource (spectrum)	Free resource (spectrum)	
	Personal income	Personal income	External/internal income	

The data from in the table above was extracted from the open codes in Appendix F. These codes led to the identification of the independent variables for the cases. In each of the phases, there was a culmination of three factors, namely the usefulness of the technology, the scarcity of existing service/technology and the relevant resources produces led to the stabilization of the group that implemented the larger infrastructure. The first phase was that of the innovators (the Geeks) who were interested in facilitating an online platform where they could play games with their peers. They had a need for a service, they knew the technology that would solve the problem, they had the resources to facilitate the technology. The technology was scarce. In the second phase the innovators decided to extend connectivity to the street and later in Eastern Johannesburg. Here the needs are no more the same as the group becomes bigger. But after witnessing the success of the geek group and what the technology could do, other people could see this technology meet their needs. The technology was also scarce and they had the resources to facilitate the technology themselves. Hence, they knew they could be masters of their destiny. In the third phase this evolving network decided to merge with other wireless groups to form JAWUG. This is now a different need, but the desire to merge was based on the fact that interconnectivity would be possible if the other networks would merge.

Hence this is a bigger need for the service as well as the technology. The group had the resources to do it, but they could not more do it as a loose group of individuals but as an organized entity. This led to the development of a much larger infrastructure.

Hence grouping these attributes as seen in the table above, the intention to deploy was necessitated by the test for usefulness results, the availability of the vital resources and the scarcity of the needed Broadband technology to meet their game playing needs. The vital resources here were *personal resource*s (intrinsic knowledge of network and self-determination), *technical resources* (infrastructure equipment and free spectrum), *financial resources* (income) and *external human resources* (technical consultancy).

CASE - AIRJALDI

The Airjaldi case was assessed in 2 ways. The first assessment was for the pre-commercialization phase and the second being the commercialization phase. The pre-commercialization phase was discovered to be more important. This was because the intention to deploy from a community effort perspective is evident. Secondly, although the pre-commercialization stage was much of a loose social project, it produces an insight to this bottom up approach.

Pre-Commercialization Phase: The intention to deploy a Broadband network emanated from the NGOs and the other individuals who invited Yahel. As seen in the table below they were inclined to invite Yahel because they had use of the network to connect to the outside world. This implies that they had the need for the email service. They had only one NGO who had VSAT connectivity and the other NGOs had to go there to communicate to the outside world. Hence there was scarcity of the Broadband internet connectivity. They also had the ability to recruit a vital resource which was an external human resource personnel in the person of Yahel.

When Yahel arrived, he had the intention of deploying a specific wireless Broadband network. In the bid to identify the suitable network he also had to identify the technology that would be useful that would also produce additional services to the NGOs and the other institutions. He could carry out his work because there was a scarcity of Broadband internet connectivity. He had vital resources in the form of broad personal resources as well as specific personal resources such as his personal interest and personal knowledge of deploying Broadband wireless networks.

Hence the intention to deploy can be identified in the two processes. The difference in the two cases is the entity driving the deployment. Hence, in order to identify the emerging constructs that led to the intention to deploy, both processes are juxtaposed in the table below.

Table 9- 5 Pre-commercialization Phase of Airjaldi

	NGOs	**YAHEL**	**Test Outcomes**
usefulness	Perceived usefulness of Internet technology and service by NGO and rural users	Perceived usefulness of relevant Broadband technology	Confirmed usefulness
Scarcity of existing service/Technology	No Broadband infrastructure and no internet connectivity	Scarcity of connectivity in remote India	Scarcity of existing service/Technology
Resources	Recruit ready help	Personal resources Knowledge of network Personal interest	Vital resource

The outcome of the cross comparison resulted in the fact that "*usefulness of the technology and service*", "*the scarcity of the technology/service*" and the "*availability of vital resources*" were the causal conditions leading to the intention to deploy. At this moment, a pattern is beginning to emerge, in comparison with the case of JAWUG of South Africa.

Commercialization phase: The factors that affected commercialization as seen in the Appendix F were the market assessment (demand and supply) to ascertain economic sustainability of the network, the presence of vital resources, business model conception and the existing potentials of the network that would sustain commercialization. The vital resources here were financial sustainability, human resources (both internal/external), the technical knowledge of the network, the network resources (spectrum etc.), and the source of bandwidth.

If one were to juxtapose the constructs of the model identified in the pre-commercialization phase with the model identified in the commercialization phase, aside the presence of vital recourses, there is no similarity between the pre-commercial model and the commercial model at first sight. However, as seen in the table below, one could see some form of similarities in the overall categorization of the causal events. These include usefulness, scarcity and vital resources.

Usefulness: Usefulness here was evident in two ways. The first was the usefulness of the network to the investors and the second was the usefulness of the network to the customers. Either way, the reference point of identifying the usefulness in both ways was from the view of the investor.

- **Usefulness of the network to the investors**: The usefulness of the network was determined by the supply assessment which leads to the incentive to explore. The incentive to explore the commercialization of the network is a product of the perceived usefulness of the existing network to the commercial needs of the investor.

This perceived usefulness emanated from:

- The knowledge about the network shared by Yahel at the Broadband conference.
- The indirect public incentives such as deregulation of Wi-Fi.
- Low entry barrier into the Internet market via low ISP fees and sub-ISP fees.
- The commercial potential of the network due to the number of anchor tenants hooked onto the network and the area of commercial interest being the lack of competition in rural areas.

The following factors contributed to the investors finding Yahel's network useful to them. These factors were:

Usefulness of the network to the users: The fact that the network had users willing to pay for the sustenance of the network provided the commercial potential of the network. Indirectly, this implied that the network was useful to the users, hence they would not be willing to pay for it. This is denoted in the table below as demand assessment.

Table 9- 6 Commercialization of JAWUG

	Concepts	Properties	Outcome
Usefulness	Incentive to explore commercialization/ Supply Assessment	Knowledge about the network	Equivalent of confirmed usefulness
		Commercial potential of the network	
		Indirect public incentive	
		Area of commercial interest	
	Demand Assessment		
Scarcity	No commercial Internet service provider		Equivalent of scarcity
Resources	Knowledge	Personal resources	Vital resources
	Network resources		
	Bandwidth source	Technical resource	
	External/internal human resources	Human resources	
	Financial sustainability	Financial resources	

Scarcity: Although Yahel's network existed, there was no other commercial Internet Service Provider in the rural area. Hence, one would say that wireless Internet technology and Service were scarce.

Vital Resources: The investors as seen in the table above were armed with personal resources based on the knowledge they had in developing wireless networks earlier. They are armed with financial resources and were opportune to acquire both internal and external human resources as well. The internal human resources were those they employed and the external human resources were volunteers who visited to help out based on their love for rural India.

Based on these three extractions, one could see that, although the pre commercialized and commercialized processes were different, the overall properties and dimensions of the causal factors aimed at developing the infrastructure were the same. Hence in the process of model development, the three constructs of Scarcity, vital resources as well as the usefulness of the technology and service led to the intention to deploy the infrastructure.

CASE - WIRELESS GHANA

In the case of Wireless Ghana Project, the intention to deploy the infrastructure can also be identified in the 2 processes as seen in Appendix G 2.4. The first process being John Atkinson's intention to deploy the infrastructure and the second process being the NGO's intention to deploy the infrastructure. As done in the first 2 cases, an attempt was made to reflect on the constructs for the wireless Ghana project as presented in section 9.1.3. The outcome of the reflections as presented in the previous cases is expressed in the next page.

Scarcity: As seen in the table in the next page, John's intention to deploy was necessitated by the lack of household Internet access in Apredie. Hence he had to adopt an individual initiative. This is why one of the constructs is the individual initiative. For the NGOs they found no other institution providing the service. For the NGO, the relevant construct from section 9.1.3 was "the perceived usefulness for commercial purposes".

Usefulness: John came from the United States where he knew the usefulness of the technology and service. He also identified the need for the service in Apredie. Once he saw the Vsat connection, he identified how useful the technical artifact could be for his idea. Hence he harnessed his personal characteristics, as seen in section 9.1.3, to facilitate the tests. The NGO on the other side of the coin could identify the usefulness of the technology for extended rural connectivity after the test via market assessment. They also found the new initiative as a means of raising money to support the NGO. The construct from section 9.1.3 that corresponded to usefulness is the "ICT Agenda of the NGO" and the result of the "market assessment".

Table 9- 7 Evolution and Causal Conditions of the Wireless Ghana Project

	John Atkinson (innovator)	**NGO**	**Causal Condition**
Scarcity of technology and service	The lack of household internet connectivity in Apredie	No internet service provider in the area	Scarcity
Resources	The redundant VSAT terminal serving the community center	The asset of the NGO	Vital resources
	His previous knowledge of setting up and using wireless networks in the US	Presence of the gateway and technical resources	
	Personal resources	Operational resource	
		John's Knowledge	
		Market assessment result	
Usefulness	He perceived the usefulness of the VSAT to facilitating Broadband connectivity at Aperidie	Commercial usefulness	Confirmed usefulness
		Technology usefulness	
		Supplementary use for NGOs operations	

Vital resources: John was also willing to initiate the process because; he had the personal resources to facilitate the technical resources and financial resources needed to test the network. The NGO on the other hand had technical resources

(VSAT and equipment needed to deploy the infrastructure such as the omnidirectional antennas and the radio equipment), Human resources (John and his team), Operational resources (administrative resources) and the market assessment results. The market assessment results were important because if they turned out negative, then the project would have been stalled.

9.3 2 CAUSAL FACTORS LEADING TO THE INTENTION TO DEVELOP BROADBAND INFRASTRUCTURE (MERGED CASE)

The reflection process produced three common independent variables which led to the intention to deploy the infrastructure. These variables are namely:

- Usefulness of technology and service
- Scarcity
- Vital resources

However, the existence of scarcity does not always lead to demand. This is because the people may have other priorities. Hence, for scarcity to lead towards demand, then the scarce resource must be an actual user need or a priority for the user. Hence the variable "scarcity" was renamed "actual user need".

Usefulness as seen in the cases was in two parts. This includes "*usefulness of technology*" and the "*usefulness of the services the technology*" would facilitate. Hence the variable "*usefulness*" is divided into "*usefulness of technology*" and "*usefulness of service*."

Hence the pictorial view of the independent variables in relation to the "intention to deploy" is represented below.

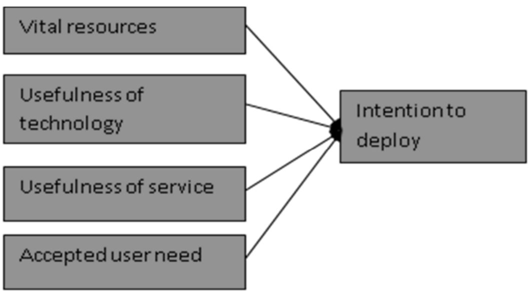


Figure 9- 19 ***Causal conditions for the facilitation of the Wireless Ghana Broadband project***

Hence the common thread that was identified as a catalyst to the intention to develop infrastructure from the developing country point of view were as follows:

- The users had need of the technology and services
- The scarcity of Broadband technology and service at that point in time, leading to the actual user need.
- The availability of vital resources. The vital resources are human, technical, financial, social, and operational and other possible form of resources that each of the cases could not do without. As seen in each case, the vital resources differed.

9.3.3 TRIAL/EXPERIMENTATION/MINI-IMPLEMENTATION (MODERATING VARIABLE 1)

Once there is the intention to develop the infrastructure, the next step identified when coding the cases was the trial or mini-implementation or experimentation (any of these words could be used). This variable was the first visible action identified in all the cases. This process was important as it further strengthened the expected usefulness of the service. This was identified in each case.

CASE - JAWUG

In the case of JAWUG, there were many trials; however, two of them were major trials. This was because the success of each major test led to another action.

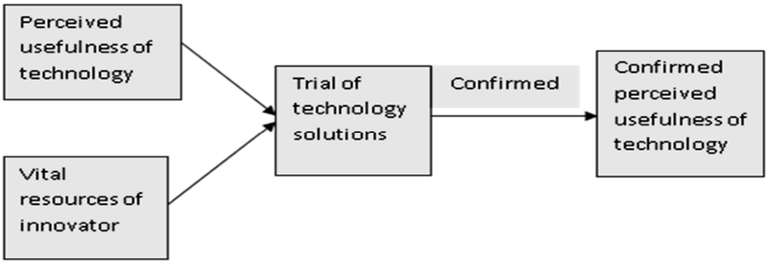
Test 1: The first major test was carried out by the Geeks to confirm their suspicion of the technology and its potential to be used in playing games. Their suspicion is considered to be a perceived suspicion. Here their suspicion was given birth to based on what they studied from school. They learnt that Wi-Fi technology could provide a platform for playing online games. Here they perceived the usefulness of the technology and service. They needed a test or trial to confirm if their suspicions were true. Once the tests were conducted and their suspicion confirmed, their certainty of the usefulness of the technology and the service became stronger.

Test 2: The second major test occurred after the Geek infrastructure expanded and there was the need to interconnect with other networks to form JAWUG as a big organization. The user need of people in need of affordable Broadband connectivity remained the same. To facilitate the expanded infrastructure, the newly formed organization had to interconnect with other sister wireless networks. This required major testings. A successful testing resulted in actual infrastructure development.

CASE - AIRJALDI

In the case of Airjaldi, the major pre-commercialization tests occurred twice.

Test 1: The purpose of the first pre-commercialization tests as identified in process 2 in the appendix G.2.2 was to identify the suitable technology. Yahel, the innovator in this case tried different technologies based on its perceived usefulness and the vital resources he had to solve the scarcity problem. An extraction of the axial coding from the appendix G.2.2 is seen below.



1*Figure 9- 20* ***Test for usefulness of Technology (Airjaldi)***

Test 2: The second pre-commercialization test was aimed at testing the effectiveness of, the identified Broadband network over a wide area with remote connections. Breaking down the selective coding for process 3, extracted from the appendix G.2.4 (theoretical outcome), one can identify that in the first phase of connectivity, this is a test towards the viability of an enlarged network

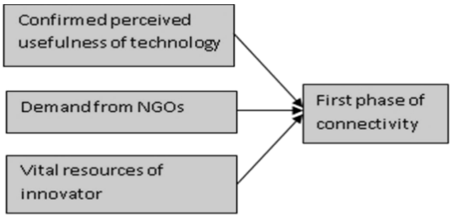


Figure 9- 21 ***Causal factors leading to first trial (AirJaldi)***

It was the success of this process that led to the actual expansion of the network as seen in the full axial coding of process 3 below, also extracted from the appendix G.2.4 (theoretical outcome), section.

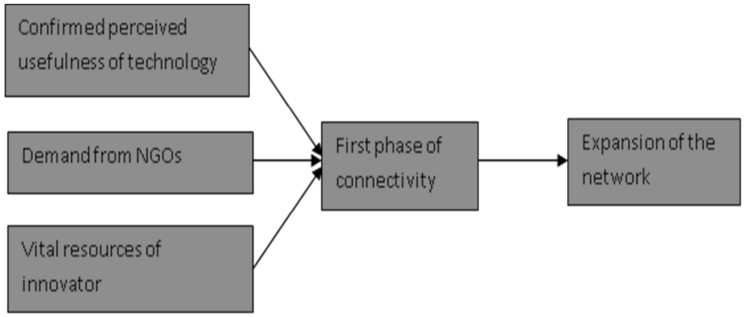


Figure 9- 22 ***Causal factors and intervening variables (JAWUG)***

In the commercial network, a trial was required for further expansion of the network into the mountainous regions of Dharamsala in India.

CASE - WIRELESS GHANA

In the case of wireless Ghana, there were several tests, but 1 major test was the pivot that determined the road to the actual implementation of the project. The test was conducted to convince the Apredie community resource center to adopt the project. This is seen as process 1 in the appendix G.2.4. The second test was the initial implementation aimed at attracting customers as seen in process 3 in the appendix G.2.4.

Process Evolution for the Ghana Wireless Project: The major tests in the case of a single organization (Wireless Ghana) facilitating a supply push were carried out once. However, in the case of evolving organizations such as AirJaldi and JAWUG, the tests occurred in an iterative manner. Every successful test aimed at expansion led to mobilization of more users. This was done till critical mass was achieved. One would say that the tests were aimed at confirming the usefulness provided the Broadband internet networks to the would-be members. It provided a new opportunity for connectivity. Most importantly, it provided an opportunity for mobilization and further forming of an organized body to either manage or implement the infrastructure.

One interesting thing about the test was that it provided a sense of empowerment for the people. They felt they could carry out the project by themselves as it provided an economic potential in the face of the public’s refusal to help.

Hence, based on the identified one intervening or moderating construct, the model evolution is represented below.

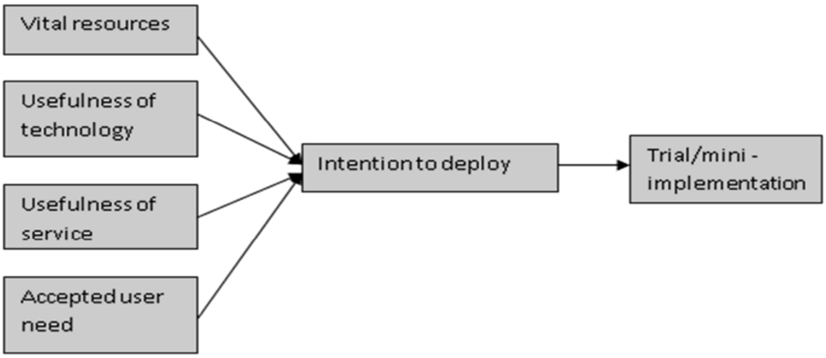


Figure 9- 23 ***Causal factors and intervening variables (Developing countries)***

Identified iterations in the Trial Process: The aforementioned iterations were no pre-planned. In the cases where the unconscious iterations occurred, failed or unconvincing trials as in the case of Airjaldi and Wireless Ghana led to retrials. These retrials as identified by the codes in appendix G.2.5 were buttressed by self-determination being a vital resource. None of the cases experienced the abandonment of the idea, however, one cannot write off the fact that a hopeless failure in the trials could have led to the idea being abandoned. On the flip side of the coin, the successful trial or retrial as seen in the figure below led to the next phase of the development process. As seen in the cases, the success or failure of the trial is determined by the technical or volunteering hands who are facilitating the implementation.

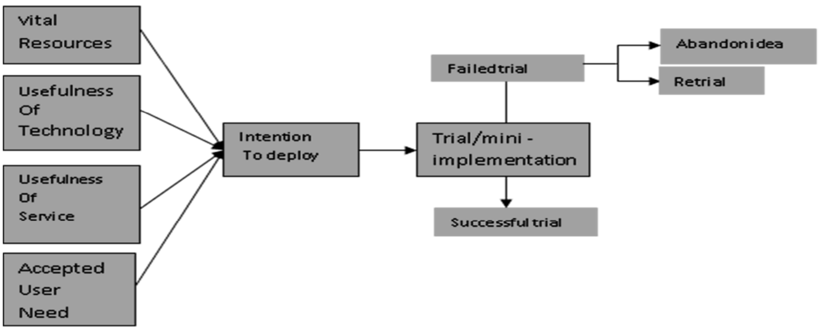


Figure 9- 24 ***Iteration process at the mini-implementation stage***

Implications of the trial Iterations: One would say that a successful trial cements the desire to implement the infrastructure. However, in the developing country cases studied, the successful mini-trial or mini-implementation exposed the potential for the development of a larger network. In the course of the open coding process as seen in Appendix E, one will realize that although the scope of the usefulness, the accepted user need as well as vital resources changed and the component that made up the vital resources did change as well. This is reflected in the table below.

Table 9- 8 Causal Factors extracted from the Developing Country perspective

Factor category	Sub-factor category	JAWUG	Airjaldi	Wireless Ghana
Vital resources	Initial vital resources	The innovators could afford the technical equipment and could set it up	Yahel's personal resources (Income, time, expertise etc.)	John's resources (both technical and non-technical)
		They knew about the potential of the technology from school	Yahel's previous experience in building wireless networks	John's knowledge
		Had free spectrum	Yahel's passion for rural connectivity	The presence of a redundant VSAT
	Latter vital resources	JAWUG could hire technical consultants	Airjaldi's personnel knowledge of how to develop the network	Johns knowledge
		They had both external and internal income streams	Airjaldi's sustainable economy	NGO's operational resources
		They had self determination	Airjaldi's use of both internal and external human resources	Market assessment results
		They also had free	Airjaldi's network	Availability of the VSAT

		spectrum	resources	and other technical resources
	Initial perceived usefulness of technology	The technology could facilitate online gaming	NGO's knew that the internet was useful to their external communication efforts	Commercial usefulness of technology which would support the NGO's operations
	Latter perceived usefulness of technology	Need for affordability internet service		
Initial Perceived usefulness of technology	Final perceived usefulness of technology	Need for External Network Accessibility	Airjaldi saw the network as a tool for providing affordable internet service	
Perceived usefulness of service	Initial perceived usefulness of service	Could play online games	The NGOs could send emails to facilitate their operations	Users could access internet services at home
	Latter perceived usefulness of the service	Could communicate at a cheaper rate using the internet services	The people of Dharamsala could use any internet service for their daily life	
Actual user need	Initial actual user need	The need to collaborate online for their assignments	The NGOs did not link the NGOs only, but also certain institutions Yahel felt should be connected	The need for access to the internet
	Later actual	The need for a communication	The network and service has been	

	user need	infrastructure cheaper than the commercial alternatives	expanded to reach businesses, institutions and individuals

Hence, one would say that although the factor category remained the same, expansion of infrastructure required the innovators in the case of Airjaldi to identify how useful the technology and the service will be for the masses. This was a shift from how Yahel, the earlier innovator handled the small network which was not intended at that moment for commercial purposes. In the case of Airjaldi, the expansion was not pre-conceived; rather it was the positive consequence of their visible network that led to the need to expand. One could also see in the table that the vital resources required in the expansion process changed as well. In the case of Wireless Ghana, the vital resources, evolved once the NGO gave its backing and resource for the project.

Hence, one can see the iteration loop occurring. The process so far can be said to be the implementation model for a process where the saturation occurs early. Saturation here is defined as the moment where critical mass is achieved to organize and manage the infrastructure. However, in the case where there are vital resources that can cater for an enlarged network, the cases studied indicate that a push is being made to organize and manage the network.

The Vital resources that were very important and seem to be the driver towards the expansion of the network are financial in nature (financial resources). Knowledge (personal resource) - be it intrinsic or extrinsic - is important. But in the case of JAWUG, during the expansion phase, they hired consultants from the ISP association to help them. In the case of wireless Ghana, John worked with the Information Technology team from the NGO, whom he transferred knowledge to, or shared knowledge with. Assuming John was not there and the NGO were to implement the same project, they could source for knowledge on how to develop or manage such a network. The technical resources could also be acquired. However, these variables of finance (financial resources), network resources (Network resources), knowledge (personal resources) and any other possible vital resource are termed vital because in their specific cases, the project would not have happened if it were not present in the context of the cases.

Having made that argument, the drive for expansion meant that a certain vital resource had to be managed. This is the financial resources, hence the more users one could gather to a network, then more the potential of facilitating an economy that will sustain the network. This required mobilization of more members or potential sources of an economy. Mobilization requires that the innovator(s) begin to look at a bigger picture in terms of the usefulness of the technology and service to the people, the vital resources needed to cater for the increase in users and the fact that they also understand the actual needs of the user.

9.3.4 MOBILIZATION (MODERATING VARIABLE 2)

As mentioned earlier, the developing country cases, needed finance to expand the network and each trial presented them with the opportunity to mobilize more people (customer, users, coop members). Trials or mini-implementation usually led connectivity closer to those the infrastructure developers would target. This was identified in each of the cases.

CASE - WIRELESS GHANA

In the case of the Wireless Ghana Project, as seen in appendix G.2.4, Initial mobilization which involved the convincing of the NGO staff and administrators came as a result of John Atkinson's test results. However, in implementing the network, supply push was adopted as the demand in this area was latent. The literacy rate was low and the level of economic activity was not as high as they are mostly farmers. The users did not see the service as important, however the NGO had to look for a way to harness active demand. The users were dormant ICT literate people who had made use of previous telecenters as well as the current ones. Their exposure to telecentres and rural ICT trainings made them computer literate rural dwellers without the ability to access ICTs in their homes. The Apredie community center had also conducted an ICT capacity building program for the people, hence there was indirect demand facilitation for ICTs here. The direct demand facilitation came as a result of the NGO providing free access connectivity, with CPUs and a directional antenna. This played a role in lowering the cost of access to the network for the users, hence leading to easy adoption. The users only paid monthly subscription fees of between 5 to 50 Ghana cedis per month. Mobilization also occurred via the convincing of clients to connect "demand soliciting", house to house visitation as well as business to business visitation. These market facilitation techniques were the mobilization tools leading to getting subscribers.

CASE - JAWUG (SOUTH AFRICA)

In the case of JAWUG, one would say that the infrastructure spoke for itself. Unlike the Wireless Ghana case, the South Africans were literate and medium income areas living in a semi-urban area. As mentioned in appendix A, 2.1 majority in Johannesburg earns between about $31000 USD to about $63 000USD per annum. The successful test for the Geeks led to a "eureka" moment. They verbally advertised their connectivity success to their friends and neighbors. The outcome of the first test exposed the potential of the Broadband technology to a wider community. Hence there was a supply-pull leading to the expansion of the network.

CASE - AIRJALDI

The Airjaldi case, on the other hand, differed as there was no demand facilitation as in the case of wireless Ghana or supply pull in the case of JAWUG. As internet connectivity was rare in this area, the demand was either low or non-existent besides the low demand from the NGOs and the few other entities. Yahel had to push supply to schools and some institutions where he thought necessary. There were no immediate plans to expand the network on a rapid scale. However, commercialization of the network changed all that as mobilization occurred via advertisements from Airjaldi.

Process Evolution: Mobilization, from a theoretical point of view, one would say was the glue that holds and translates one trial/mini-implementation attempt of another until the organization that manages, expands and sustains the infrastructure is formed. However, from the data, one could see that in the case of Wireless Ghana, the organization was facilitated by civil society, In India, Airjaldi was facilitated by a close relationship between Yahel and the NGOs and few others volunteers. In South Africa, the organization was facilitated by enthusiastic geeks. Despite this variance in the shape and composition of the innovators driving change, one could see a flow of the process that coincides with Rogers diffusion of Innovation theory as seen in the table below.

Table 9- 9 Identified elements of Diffusion of Innovation Theory

	Innovator	Early adopter	Later adopters
Ghana	Individual	Organized NGO	
India	Individual/loose group	Individual	Organized Investors
South Africa	Geeks	Geeks/Friends/Neighbors	Organized JAWUG

However, in expanding the process model developed so far, one could see another iteration process once mobilization is achieved. In the table above, the innovators one would say that the innovators developed a mini network and found it useful. They proceeded to invite more users who are the early adopters. As mentioned in the trial phase, the causal factors remain the same, but increase in magnitude to accommodate the larger group. In the cases studied so far, aside the Wireless

Ghana project, it was in the late adopter stages that the organizations that would manage and implement the infrastructure were formed. The process is represented by the diagram below.

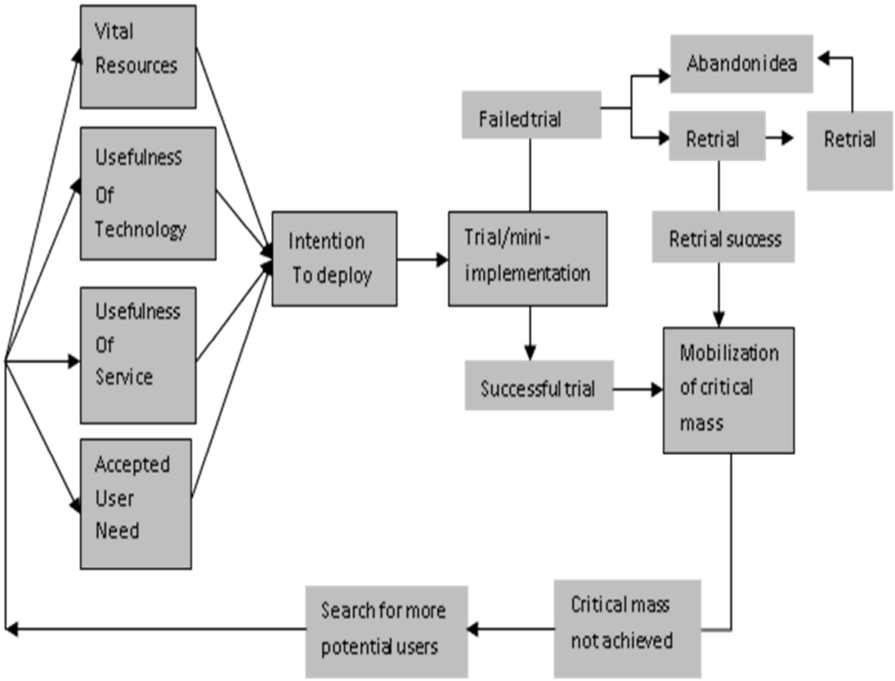


Figure 9- 25 Iteration process in the developing country process

However, it is important to note that the iteration could occur as many times as possible until critical mass is achieved. This is called the mobilization saturation point. However, from a theoretical standpoint, the modelling outlook is expressed in the diagram below.

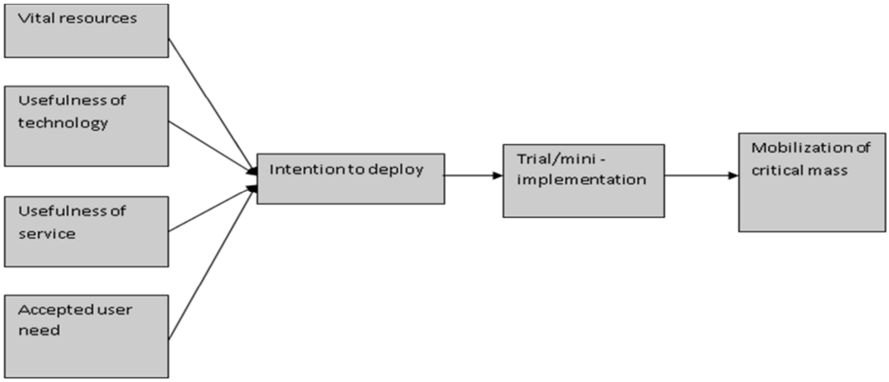


Figure 9- 26 ***Causal factors and intervening conditions (Development process)***

Need for PPP/PPI: The final mobilization phase is where JAWUG sought for public help. It was also at the final Mobilization phase that led to the transformation of “Yahel’s network”, to Airjaldi. It was in the final mobilization phase that led to Wireless Ghana mass recruiting members. This is where Public Private Partnerships can occur. It is difficult to know the final mobilization phases, but one can say that once there is a sign of stability, where there are committed people who can easily form co-ops and social enterprises, then some form of organization could be facilitated to partner with the public and possibly private sector. This will be discussed later in the report. One can call the mobilization phase, the make- or -breaking point of fledging rural Broadband networks in developing countries.

9.3.5 IMPLEMENTATION (DEPENDENT VARIABLE)

In studying the emerging coding and reflection process, it was realized that full scale and a more aggressive implementation occurred once critical mass was achieved and an organization was formed. In the JAWUG case, the intention to deploy led to lots of mini-trials aimed at expansion. The organization occurred later. It was the growth of the technical wireless network that created the need for an organized JAWUG to be formed. In the case of pre-commercialized Airjaldi, Yahel and his group of volunteers controlled the implementation of the network. Here one would say that there was an informal organization that implemented and managed the network. However, in the post-commercialized network, the usefulness of the network was the primary target of the investors. In this case, the economic viability of the network was important. Once this viability was confirmed, there was a rollout. However, from another angle one would say that the unconscious mobilization of the investors led to a large scale implementation. In the case of Wireless Ghana, The NGO was the one being mobilized by John. He knew that if he had the NGO’s backing, they would in turn mobilize the people. So in the three cases studied, one would say that some form of direct or indirect mobilization led to the formation of an organization that would manage, implement and expand the network.

Hence, based on this analogy extracted from the reflection of the process, Implementation is seen here as a process where there is a conscious effort to develop telecom infrastructure by an organized body. This definition of Implementation is just for the purpose of the analysis and not a general definition.

Standing on this definitional understanding, the full picture of the development process can be seen below.

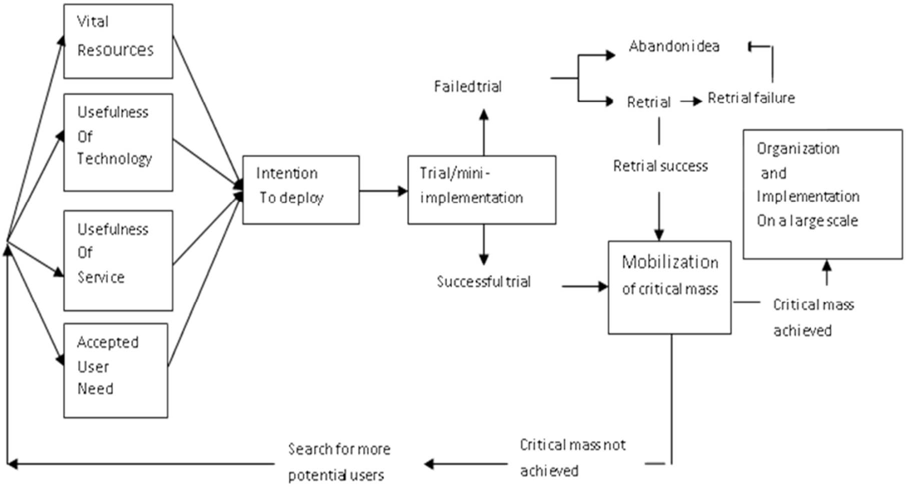


Figure 9- 27 ***Iteration process during the causal process and the intervening process***

9.3.6 HYPOTHETICAL MODEL FOR DEVELOPING COUNTRIES

Drawing on the similarities of the processes in each case, the composition of the emerging model identified in the developing country cases were, the intention to deploy, trial, mobilization and implementation. The actions were trial and mobilization. Implementation as the outcome (consequence) of the actions. Let us take look at the variables one by one:

Intention to deploy: The identified causalities that led to the intention to deploy were:

- The Vital resources
- The usefulness of the technology

- The usefulness of the service
- The actual user need

Action/Interacting Strategies 1: This involved Trial/experimentation/Mini-implementation

Action/Interacting Strategies 2: Mobilization

Outcome: Implementation

Hence, in the developing countries, there is a possibility that an individual, a set of individual or an organization will be develop the intention to facilitate the development of either fixed or wireless Broadband infrastructure if they have the following variables exist.

- They can identify how useful the Broadband technology will be for them.
- They can identify how useful the Broadband services will be for them.
- They had the relevant vital resources in their case to facilitate the development of the Broadband infrastructure.
- They can identify if they really need the Broadband infrastructure or service in their lives.

If the intention to develop is positive, meaning that all the causal factors exist, then they will attempt to test the infrastructure development in a small scale. This is to ensure that the vital resources they have can cater to their need for connectivity. If the intention to develop is negative, meaning that one of the causal factors does not exist. Then there will be no trial. This is because all the four causal factors are important with regards sustainability of the infrastructure.

The testing or trial phase is the first action/interaction between humans, technical artifacts and ideas. The trial process is heavily influenced by the social factors of the individual or within groups of individuals. Here interpersonal relationships glued by common purpose, served as the steam that drove their passion.

Successful tests can lead to implementation if an organized group is facilitating the process. The theoretical outcome would then be expressed as seen in the diagram below.

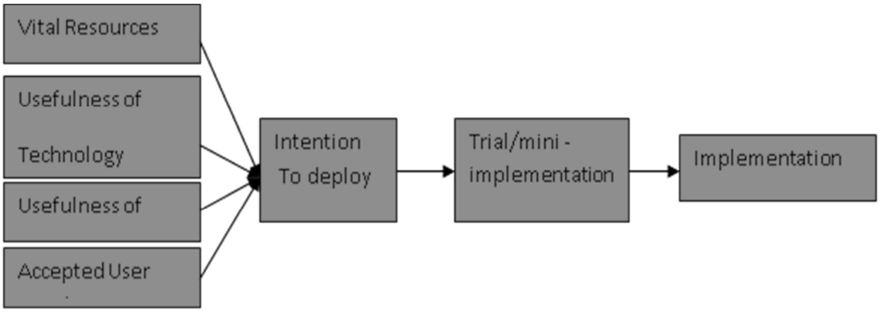


Figure 9- 28 Hypothetical Model for developing countries variant 1

However, as identified in the reflection process recorded earlier, some of the developing country cases were not facilitated by an organized group. They were rather facilitated by a group of individuals who were exploring. As they explored, they found new forms of usefulness of the network that will be of benefit to a greater group of people. Hence, they decided to mobilize more users. Hence Successful trials resulted in the mobilization process. Once critical mass was achieved, organizations were formed that proceeded to manage and implement the infrastructure on a greater scale.

The diagram below is the hypothetical model outlook in the process of facilitating Broadband internet network in rural areas of developing countries.

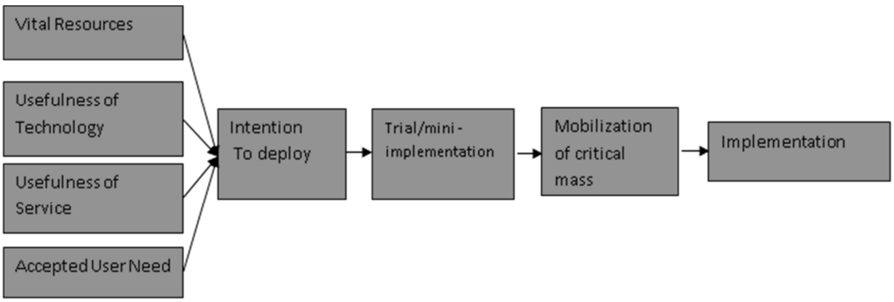


Figure 9- 29 ***Hypothetical model for developing countries variant 2***

9.4 CROSS-CASE ANALYSIS FOR DEVELOPED AND DEVELOPING COUNTRY CASES

This is an inter-model analysis between the developed and developing country models to identify the common and strong causal factors that can lead to the outcome in a universal hypothetical model. Effort is also made to identify the actions/interactions that were triggered by the causal factors to produce the outcome, which is the implementation of the infrastructure.

9.4.1 IDENTIFICATION OF CAUSAL FACTORS FROM CONTEXT

The tables below present a cross-case between the developed-country model and the developing country models. The process identified for the municipality will not be used in the cross-case analysis between the developed and developing country. This is because the process differs from that of the coops. Hence, the model will be mentioned in the discussion. The first table juxtaposes the independent variables in both models. The causal factors identified for both developed and developing country cases are expressed in the table below.

Table 9- 10 Comparison of Casual Factor between the Developed and Developing Countries

	Developing country	**Developed country**
1	Vital resources	Vital resources
2	Usefulness of technology	Perceived usefulness of technology
3	Usefulness of service	
4	Accepted user need	
5		Deployment possibilities of the technology

The shared causal attributes in both cases were:

- The vital resources
- The usefulness of the technology

The differences lie in the fact that in the developing countries, the end user had to understand the usefulness of the service and accept the fact that he or she needs the service. In the developed countries, what was important was how the technology will be deployed, especially in cases where there was no external professional technical help.

In the process of reflecting, the question on whether the causal attributes lacking in both ends would have been useful in the regions where these attributes were not causal factors. It is possible to envision that "*deployment possibilities*" can also be an important attribute for the developing countries as well. Assuming there are few technical retirees or unemployed graduates living in such a rural area, there is the possibility that they would think of deployment possibilities as a causal factor towards the "*intention to deploy*." It is also possible to say that, although the cases studied portrayed that the people living in the rural areas in developed countries knew the usefulness of the service. This was because of their education level and interaction with the nearby cities where these services are used. Assuming this service were unknown to them, then the usefulness of the service and the acceptance of the fact that they need the service would be important.

Based on this line of thought, one could envision the causal factors aimed that would trigger actions/interactions towards Broadband infrastructure development in rural areas by coops would include the following:

- Vital resources
- Usefulness of the technology
- Usefulness of the service
- Accepted user need
- Deployment possibilities of the technology.

However, it is important to note that a deployment possibility as seen so far is not a strong causal factor. This is because a self determined group of individuals would rather conduct tests till they get it right.

9.4.2 INTERACTION/ACTION PROCESS AND OUTCOMES

Once the causal factors have been identified, what actions or conditions would these factors lead to? In identifying the conditions or action/interaction that resulted from the causal conditions, the actions/interactions identified from the developed and developing country hypothetical models had to be analyzed. However the developed country model adopted here is the first model, where trial/mini-implementation occurred before mobilization. This model was adopted because as seen in the table below, the interactions were similar to the developing country cases. The table below contains a list of the condition and actions based on their order of appearance in each model. The only addition which does not exist is the deployment certainty.

Table 9- 11 Comparison of the Intervening Variables

	Developing country	**Developed country**
1	Intention to deploy	Deployment certainty
2	Mini-implementation/trial	Mini-implementation/trial
3	Mobilization to gather critical mass	Mobilization to form coops

The shared action/interaction attributes in both cases were, trials or mini-implementations and there were mobilizations. The difference is based on the fact that the developed country cases were certain of what they wanted to do and committed to it. Trials here occurred not as a means of making up their minds to deploy the technology. However, on the other side of the spectrum, convincing of administrators in the case of wireless Ghana was necessary. In the South African case, the Geeks had to succeed first before they saw the possibility of extending the network. In the Dharamsala case in India, the success chalked by Yahel made it possible for investors to decide to expand the network. Hence, in the case of the developing countries, there was an intention to deploy as the bridge to cross.

In developing a grand model, the question here would be if, the variable "*intention to deploy*" is necessary? If one looks back at the new set of causal factors, one would say that the existence of these factors, all things being equal, would lead the development of an intention to deploy the infrastructure. Once the intention is certain, then the facilitator of the process would then conduct trials to confirm the independent variables identified as the causal factors. If the independent variables are confirmed, then the facilitators would organize themselves to implement.

Hence the grand model will look like the diagram below.

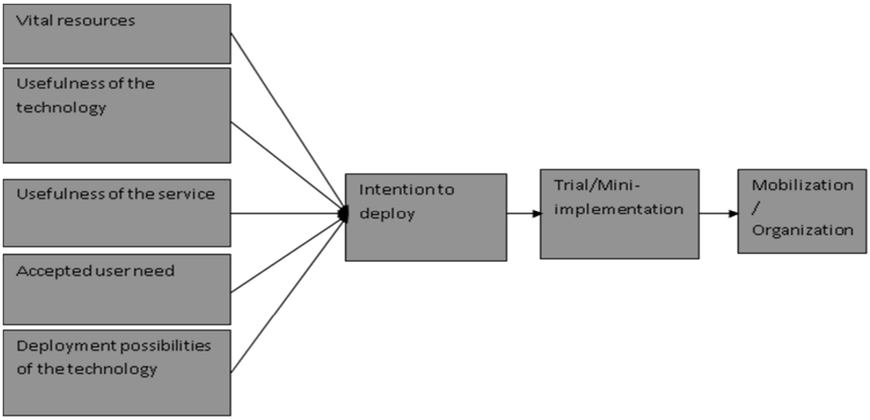


Figure 9- 30 Causal condition and Intervening conditions for the grand model

The outcome, which is the dependent variable in both cases, is expressed in the table below. The dependent variable in this process is the central theme and that is "*implementation*". In this case, these are the outcomes of the process.

Table 9- 12 Central Themes of the Developed and Developing Countries

	Developing country	**Developed country**
1.	Organization and implementation	Implementation

In the developing country cases, organization and implementation occurred after mobilization, however, in the case of the developed countries, implementation occurred after an organization was formed. However, in developing the grand model, it is assumed that the implementation will occur once there is mobilization/organization.

Hence the complete abstracted model would be:

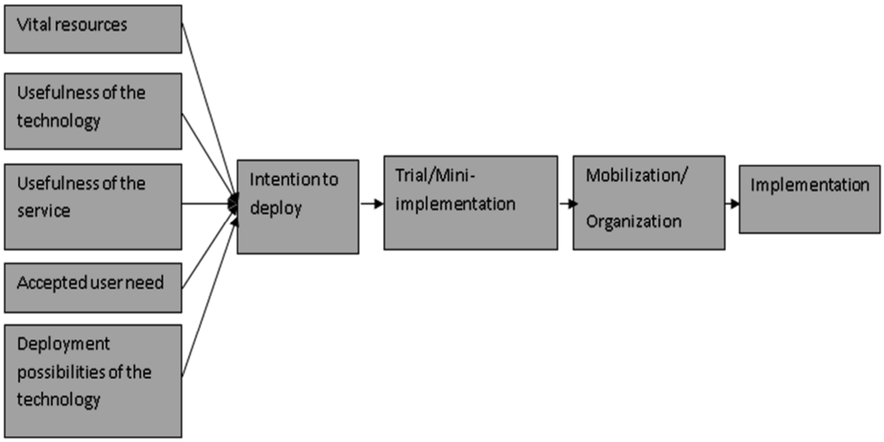


Figure 9- 31 ***Grand model***

9.4.3 STORYLINE FOR THE HYPOTHETICAL MODEL

Based on the outcome of the reflections, the hypothetical model construes that the facilitation of fixed or wireless Broadband infrastructure is possible if the intention to deploy the infrastructure can be harnessed. The causal factors that would enhance the intention to deploy are:

- The availability of vital resources,
- The usefulness of the technology to the people
- The usefulness of the Broadband service to the people
- The assurance that the people really see their need for this service
- The deployment possibility of the technology

Once there is an intention to deploy, the possible action in an area with low financial resources would be to conduct trials. Successful trials, if it confirms the usefulness of the service, the usefulness of the technology and the actual user need, will enhance mobilization of critical mass. It is the critical mass that would lead to the Broadband Coop or an organization which will implement the infrastructure in an organized way.

This model needs to be tested before it could be accepted as an accepted theoretical model. At the moment, it is a hypothetical model. The models of importance are the developing and developing country model. The grand model was only developed to fulfill the requirements of Grounded Theory.

9.5 DEVELOPED COUNTRY CASE 2 – ANALYSIS OF THE ALMHULT MUNICIPALITY BROADBAND INITIATIVE

The public sector case analysis using Grounded Theory was that of Almhult municipality Broadband carried out separately. This was because this was a top a mixture of a top-down and a bottom up approach. However, the top-down approach was decoupled from the bottom up approach to understand the process from top-down. However, it is important to note that developing a hypothesis with a single case does not ascertain internal validity of the model. However, as in the developed country and developing country cases, the hypothetical model is just a means of understanding the relationships in the analysis of the cases using Grounded Theory. To ascertain the internal validity of this model, more interviews will be needed. This will provide a much deeper understanding of the public interest effort in facilitating rural community Broadband networks via PPP.

In reflecting on the process, the first agenda was to understand the contextual factors that led the municipality to plan this project. The second agenda was to understand the actions/interactions that were triggered towards achieving the outcome. The outcome here being “implementation” of the FTTH in Almhult municipality in Sweden.

9.5.1 FACTORS THAT LED TO MUNICIPALITY PLANNING (CONTEXTUAL FACTORS)

In the process of coding, it was clear as seen from the appendix G.4.1 (theoretical outcome) that the municipality effort were affected by three independent variables. These were:

- The municipality’s decision to develop the infrastructure.
- The Coops decision to partner the Municipality.
- The private sectors desire to invest.

The three factors were pathways facilitated by the municipality to help them plan the infrastructure rollout. One would say that these independent variables were predetermined by the municipality. Each of the three factors provided the municipality with a vision of who to work with. These were the Broadband cooperatives and the private sector. These were predetermined actors, and they were also actors who were involved in Broadband development.

However, the stronger variable was the municipality's decision. This is because if the municipality did not decide to invest in developing the infrastructure, the PPP arrangement as it stood would not have been. The municipality was the glue that stuck the Broadband coops and the private sector together. Based on this premise, the municipality decision will be given more priority in this section.

Municipality's decision (Independent variable 1): For the municipality, the decision to implement the FTTH facility was affected by the following factors. The factors are extracted from the coding process and explained briefly to outline the drivers and reason for these factors as identified in appendix F.3.

Table 9- 13 Factors leading to municipality decision

	Factors	Explanation of the factors
1	Political Will	The determination of the Almhult municipality to develop FTTH. The drivers to this political will were: • The existence of similar FTTH development in other parts of Sweden. • Their previous experience in the development of Wi-Fi for the municipality. • The provision for municipality intervention in the Swedish Broadband policy.
2	Perceived usefulness of technology	The municipality were convinced that the data rates provided by fiber optics were much better than the existing fixed and mobile technologies. They had plans to roll out sensor monitoring for seniors as well as facilitate e-government activities.
3	Choice of technology	FTTH was chosen as a result of the storm of 2005, which affected the existing ADSL and mobile technologies, fiber optic technology was seen ad durable, storm proof and also provider of data rates that will facilitate seamless e-government activities.
4	Efficiency of technology	The municipality identified the Quality of Service of fiber optics reliable for their activities

5	Prior coop initiatives	Certain parishes had begun facilitating FTTH by forming co-ops. The parishes adopted this measure after the telecom infrastructure in these areas was destroyed by the storm of 2005. The municipality saw the ability of these parishes to form coops as a potential for planning the deployment of the FTTH in different other parishes.
6	Public Support	The public support incentives were provided by, the municipality and from the EU. The municipality had financial support of 40 Million SEK in supporting the coops. The municipality had a fiber optic network meant to connect their out stations where they could serve as a backbone for the coop FTTH networks. The EU had annual funds for coop activities as well funds that cover 50% of the municipality expenditure for the project. These possibilities had to be relayed to the municipalities.
7	Municipality Return on Investment (ROI)	The municipality in their calculations realized that the municipality could recoup its investment over time via the interconnectivity paid by the co-ops to interconnect to the municipality fiber-optic backbone.
8	Private sector gain	The politicians and the municipality executives were not technically minded people. Hence they had to outsource the technical facilitation and operation to a private entity for three years. The Private entity would operate on a three year, renewable, operating contract. The contract made room for another private entity operating with the main private entity, that will provide the Broadband Services of IP TV, IP telephony, and other Internet enables services. ZITIUS won the bid as the private sector manager and operator of the infrastructure, Qualcom, its sister company came in as the Internet Service Provider. However, the private sector were enticed by their ROI which came from the service payment from coops on the services used and technical help offered to the coops.
9	Vital resources	The major vital resource for the municipality was the knowledge of the fact that FTTH can aid in the facilitation of a durable telecom infrastructure in the municipality. Secondly, the municipality executives and the politicians had knowledge on how to plan a Public Private Partnership, based on the experiences of other municipalities in Sweden as well as the experience of the coops in the municipality and in Sweden. Hence knowledge was a vital resource. This was because if the municipality had no knowledge of how to organize the actors they identified, probably the infrastructure would not have been developed.
10	Motivation for Municipality	Based on the aforementioned factors, the municipality saw the decided to facilitate the infrastructure. However, the bridge between the decision and actual implementation needed some form of motivation. The motivation

Intervention	had to cater for the availability of demand or need for the service and the supply possibilities. The following possibilities led towards motivation to implement the infrastructure as identified from appendix F.3.	
	Demand pull	The effort of some parishes to facilitate FTTH exhibited some form of demand pull that the municipality capitalized upon.
	Municipality investment	The municipality had the resources to invest in the project
	Bad user experience	The QOS of mobile telephony was poor and still poor at the time of this research. The penetration of ADSL was low and the storm of 2005 led Telia not to immediately repair the dilapidated infrastructure. Telia had no universal service obligation and hence the residents lost the case against Telia to compel them to repair the infrastructure quickly. Telia were reluctant because the population in the area was low and the infrastructure was old, making the spare parts extinct. Hence Telia, at that point had no immediate motivation to restore the network as the cost would be high. Today there is some form of restoration from Telia.
	No competition	There was the existence of a market failure based on the experience mentioned in the previous point above. Based on these drivers, the municipality saw their intervention as a way of providing a long lasting infrastructure that will provide a better QOS. This became their selling point to the coops.

Hence the decision to implement the infrastructure based on the aforementioned factors extracted from the Axial coding process is represented in the diagram below. The diagram is extracted from appendix G.4.1

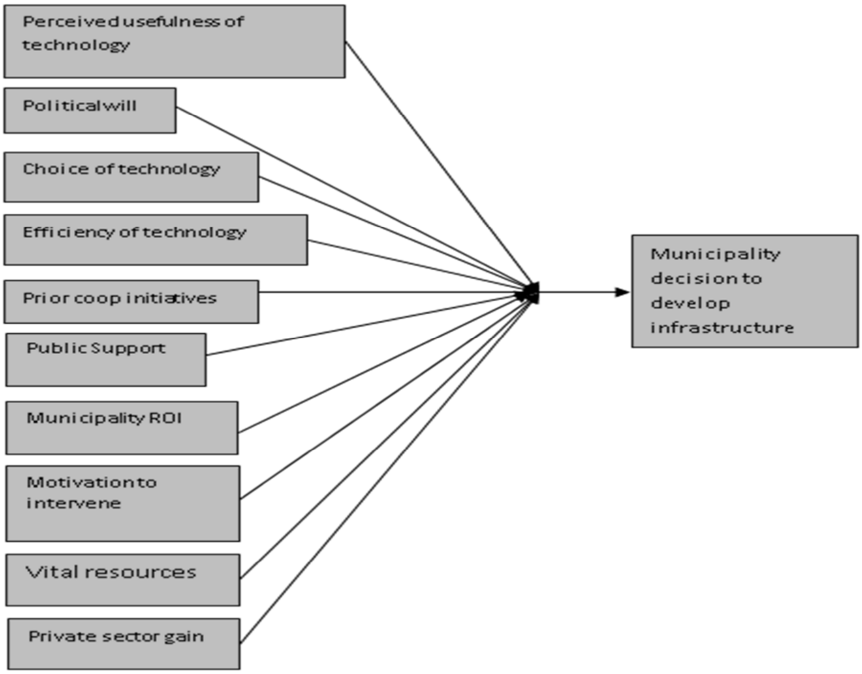


Figure 9- 32 ***Causal conditions for municipality decision***

Once the Almhult municipality had created a pathway by which they could partner the coops and private sector, the next step was to plan the infrastructure roll out process.

The Coops Decision to Partner the Municipality (Independent variable 2): The municipality hoped that the Broadband coops, if given favorable terms and incentives would be willing to partner with the municipality to extend the Fiber optic backbone to their parishes. This hope was also hinged on the fact that some parishes had FTTH Broadband coops working hard to facilitate FTTH. Hence the municipality believed that other co-ops could be formed with the right incentives, they could work together with the municipality. The incentives provided were financial incentives, the incentive of ownership of the fiber optic network and membership coordination. The details of the incentives provided are discussed under the enrollment process in this section.

The Private Sectors desire to invest (Independent variable 3): The Municipality also hoped that the Private sector would be willing to work together with the municipality if they were given some sense of ownership during the lease period. A little more on this is discussed in the enrollment process.

Hence the process development so far is represented in the diagram below is extracted from appendix G.4.1.

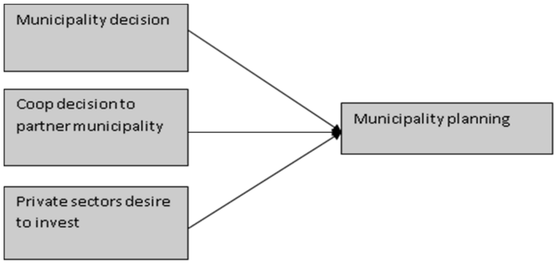


Figure 9- 33 ***Causal condition for Municipality planning***

9.5.2 MUNICIPALITY PLANNING (ACTION/INTERACTION 1)

The municipality planning was the first action one the municipalities were sure of whom they wanted to work with. The next step was to find out how they would work together with the new partners? What would be the responsibilities of the partners? Who will own what and what would be the timeline for the project?. This action was carried out by the politicians in the municipality. The planning phase as extracted from appendix G.4.1 involved the following as expressed in the table below.

Table 9- 14 Aspects of municipality planning.

	Plans	**Explanation of the plan**
1	Purpose setting	This implies defining the need of the infrastructure to the municipality and to the coop. The need for the municipality was to connect their out stations and facilitate e-government. The need for the co-ops as defined by the municipality was to provide an affordable high speed Broadband infrastructure that is durable.
2	Infrastructure delineation	Here the municipality decided that the municipality backbone is owned by the municipality and the fiber optic infrastructure facilitated by the co-ops is owned by the co-ops.
3	Timeline	They municipality drew a timeline of 2015 as when infrastructure development will be complete. The next phase would be planned.
4	Interconnectivity	The municipality backbone was interconnected to Tele2 Infrastructure provided by Tele2 to Almhult municipality. The co-ops will then

		interconnect with the municipality backbone.
5	Coop divisions	The coops were grouped according to the old church parish system. They were 9 coops in all. Each coop had a board that will relate with the municipality.
6	Coop responsibility	The coop handled the digging and as a result managing right of way. They co-ops had the responsibility to raise money for the project as well as for the sustenance of the coops. The co-ops were also responsible for paying the monthly interconnectivity fee to the municipality backhaul and service charge for the service used.
7	Municipality responsibility	They provide partial funding for the project; they act as an intermediary between the private sector and the coops. They get feedbacks from the coops on the service of the private sector. They hire the private sector as well as provide financial support where the coops may need it in the form of a loan.
8	Private sector ROI	The municipality draws the business model for the project and fashions out how the private sector would benefit from the process.
9	Affordability	The Municipality decides the access fee for the coops to provide a uniform platform for all the coops. Secondly, the municipality ensures that the ISP, Qualcom is a platform with multiple service providers, where the citizens have the right to switch the subscription if they want to. Thirdly, citizens are not forced to sign up for the service. They could only pay for access if they want access only. However, the connected citizen must pay the annual coop membership fee. They are interested in making the service affordable at the end of the day. It is important to note that this is what happened in Almhult and is not a standard. However, what is important here is that the planning has to be done. Once the planning was clearly spelt out, the next step was to recruit the identified actors to play their role. This is called termed the enrollment of partners in this report.

9.5.3 ENROLLMENT OF PARTNERS (ACTION/INTERACTION 2)

At this stage, the municipality decided to enroll the other main actors that were deemed necessary for the implementation of the project. The first was the co-ops and later the private sector player. The municipality had already enrolled itself.

Coop Decision to Partner in the Project (enrollment 1): This variable was important as the unwillingness of the co-ops to join this project would defeat the aim of the project. This is because there is no formal administration below the municipality level, hence the municipality decided to demarcate its citizens along the lines of the old church parish system just for this project. However, as identified in the coding process in the appendix G.4.1, aside the 2 co-ops that existed earlier, there were no co-ops in these demarcated parishes. Hence, as seen in the coding process, the municipality had to transfer their ideas to people living in the other parishes. Once the invited citizens bought the idea, then they would sell the idea to their neighbors and form co-ops to be a part of the project.

The process as extracted from the appendix G.4.1 is expressed as follows.

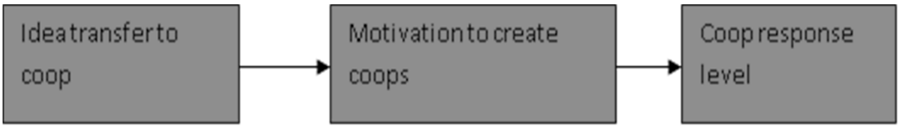


Figure 9- 34 Motivation to create coops

As seen in the diagram above, the enrollment was a linear event, where the municipalities attempted to transfer their idea of partnership to the Broadband coops and would be Broadband coops. The successful transfer of the idea meant, the coop and would be coops were fine with the incentives and found their responsibilities easy to accomplish. The process is explained in the table 9.15.

Table 9- 15 Possibilities for creating Coops

	Process	**Process explanation**
1	Idea transfer	In this process, the municipality invited people from parishes to a meeting at the Almhult city hall. Here the municipality did present their idea and also invited the chairmen from existing coops to talk with those present. The storm of 2005, the poor quality of service of the mobile service, the low penetration of ADSL, the fact that by 2020 technology would change and if Almhult does not rise to the occasion they would be left behind were major points used to convince the attendees. The attendees were also given seminars about FTTH and the possibilities it presents to them.
2	Motivation to form coops	The motivation to form the coops as gathered from the interviews was not necessary about the technical issues. It was more about the fact that they will have a durable infrastructure that will not be affected by the storm. There was greater interest in younger people than in the older generation. Aside these factors, municipality funding, the possibility of EU funding and the fact that they could afford the one time access connectivity fee of between 20000 SEK to 25000 SEK was key to the invitees going back to form coops.

The level of response from the coops led to the formation of management teams making them ready to partner with the municipality as seen in the diagram below.

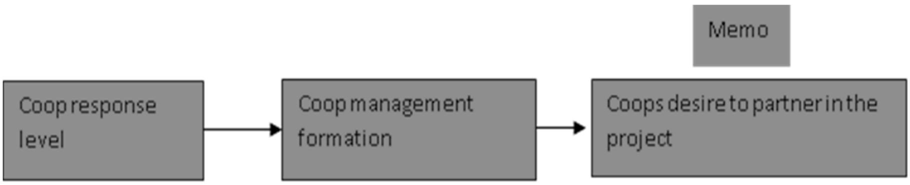


Figure 9- 35 Coops desire to Partner in the project

The co-ops that were already in existence, once convinced they were ready to partner with the municipality, as the municipality and the EU would bear much of the financial burden of the expenses.

The Private sector's desire to invest (enrollment 2): The private sector's desire to invest is influenced by the perceived ROI in the market. The private sector ROI is made possible by the income opportunities for the private sector and the level of control the private sector has in managing and operating the infrastructure.

Table 9- 16 Enrollment of Private sector

	Private Sector Interest	Explanation of the role f the private sector
1	Income opportunity	Coops pay municipalities for the service, ZITIUS, the infrastructure company provides for the coops. Part of the monthly interconnectivity fee goes to ZITIUS for maintaining the Municipality fiber optic infrastructure. Coops also pay monthly embulk to Qualcom service providers of the services used by their members. There are about 350 number of households in Hallaryd, hence it is a promising market.
2	Level of infrastructure control	The 3 year contract between Zitius and the municipality entails that Zitius has complete control of the management and operations of the infrastructure within this period. This act gives Zitius the free will to manage the infrastructure in its interest. However, Zitius also has to make sure that the interests of the coops are taken into consideration else, its contract would not be renewed.

Hence, as extracted from the appendix G.4.1, the figure below denotes the private sector's desire to invest

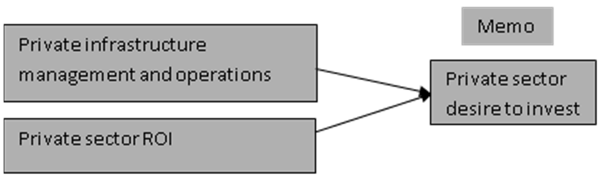


Figure 9- 36 Causal factors for private sector's desire to invest

Unlike the developing country cases where iterations occurred during the mobilization phase, the Almhult municipality did not have to go through these iterations as they were able to identify what would facilitate demand push in areas where no coop existed. The basic fear of not having communication possibilities in the future either as a result of an obsolete technology or natural disaster was enough to drive people to accept the process. Most importantly, the citizens could afford the service. One would say that in a developing country that is poorer than Sweden, the challenge would be in crossing the affordability threshold. However, the process so far can be seen in the diagram below.

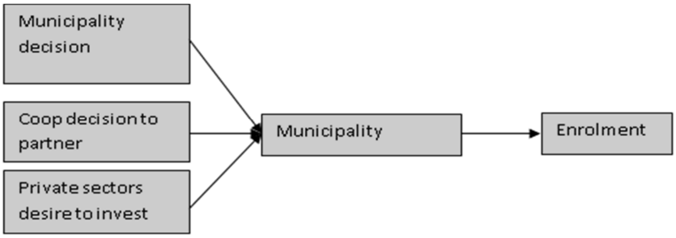


Figure 9- 37 ***Causal factors and intervening conditions for the municipality initiative***

9.5.4 INFRASTRUCTURE DEVELOPMENT

As seen in the enrollment process, an enrollment was only said to have occurred, once the partner could identify the benefits accrued to them and they decided to go ahead with the process. It is important to note that this enrollment process is not universal, but just unique to this case. It could differ from case to case and context to context. However, once there is a successful enrollment, this implies that the partners are willing to play the roles assigned to them. Then actual infrastructure development took place.

Hence the full process is expressed in the diagram below.

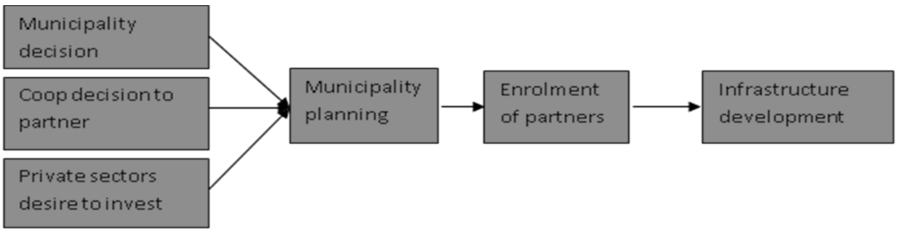


Figure 9- 38 Municipality initiative for municipality process variant 1

The diagram above outlines the process adopted by the public sector studied in this case. If this hypothesis is to be generalized, as it is moderated by the municipalities, one could merge the co-ops decision to partner the municipality and the private sector's desire to invest as identification of municipality partners. Hence the hypothesis would become:

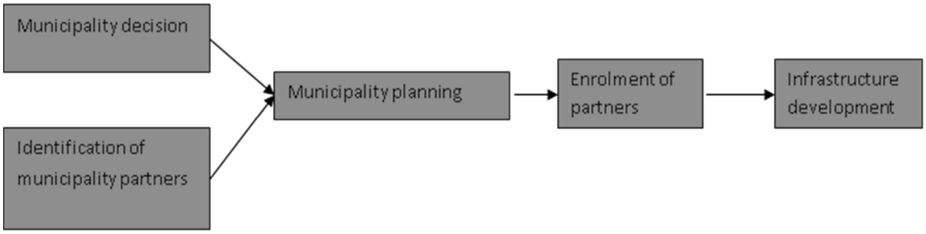


Figure 9- 39 Municipality initiative for municipality process variant 2

However, this scenario is hypothetical and would require some tests to verify if the relationship holds. However, from the analytical point of view, one could say that the decision to implement this infrastructure was influenced by the municipality's decision to implement the infrastructure and the willingness of the identified partners to join in the process.

CHAPTER 10. DESCRIPTION OF THE SECONDARY CASES USING THE STAKEHODER ANALYSIS

10.0 INTRODUCTION

This chapter mainly describes the secondary - cases, namely the Universal Service ecosystem in Nigeria and Ghana. In this chapter, an attempt will be made to describe the stakeholder relationships in both ecosystems as well as identify the types of PPIs that exist thereof with the funding mechanisms.

The chapter is divided into 3 sections. The first section is the preamble. The second section is a stakeholder description of the universality fund ecosystem in Ghana and how it is managed. The third section is a stakeholder description of the Universality fund in Nigeria and how it is managed.

10.1 PREAMBLE

In this part discussion is made on some identified community based initiatives in sub-Saharan Africa besides the Republic of South Africa. The rational for analyzing Universal Service funds for the secondary - cases and the rationale for choosing the secondary cases is also explained in this section.

10.1.1 IDENTIFIED COMMUNITY NETWORKS THAT WERE NOT USED IN THIS RESEARCH

It is important to note that there could be attempts to develop community networks in Africa. Some may not be mentioned in this research as a result of ignorance towards its existence. However to limit that ignorance an attempt was made to locate some of such cases. The snowballing sampling method was adopted to identify some. Examples of those identified include:

- Community Based network simulation performed in Tanzania in the Bunda and Segrengeti Districts (Nungu & Pehrson, 2011).

- Macha Works in Zambia

Overview of the Tanzanian Rural ICT Case: The Tanzanian case was a project funded by the Swedish International Development Agency (SIDA). The partners were the Tanzanian commission of Science and Technology (COSTECH), The Dar Es Salaam Institute of Technology (DIT) and the Royal Institute of Technology, Sweden (Nungu, Brown, & Pehrson, 2011). The ownership of the network, in theory, was facilitated via a Public Private Partnership between the municipality (local government), local representatives and the members of the community. Unfortunately the project does not exist anymore.

Overview of Macha Works: Macha works was one of the first cases identified at the beginning of this research. However, it was difficult to investigate this case as the Zambian telephone numbers on their website were not correct. Secondly, the Macha works contact persons in the US and UK were not aware of the Zambian case. Reference was made to a personnel working with Computer AID, a UK ICT for development non-profit organization. Unfortunately the individual could not be reached with the contact details given; hence the search for Macha Works on a practical note did hit a dead end.

However, secondary information gathered about Macha works was gathered from the Macha Works Website and then 3 years later into this research from Nungu, Brown and Pehrson (2011). It is a case where the Actor Network Theory could have been used to describe the process of translation. However, as it was impossible to have full details of the process, it is still wise to describe the case as presented by Nungu, Brown and Pehrson (2011). In their description, Macha is a rural community located in the Southern Province of Zambia. The population of the village is about 128,000, with 20,000 households as at 2011. Most of them live in mud houses and the radius of the village is 35KM. A Dutch telecoms engineer, moved to Macha to join his wife who served as a Doctor in malaria institute. The malaria institute, provided the seed capital of $50 000, for the initial internet infrastructure. The anchor tenants to the internet infrastructure in Macha were the hospital (malaria Institute), the Internet Café, the community center and the primary school. Macha Works a non-profit organization was set up and registered in the Netherlands to manage the communications networks at Macha. Macha works international has expanded its scope of operation to include healthcare, Education, Energy and water as well as transportation.

The rationale for not using them as cases in this study: Macha works, was not used in this research, not only as a result of the dead end experienced by the inability to trace this initial project, but because there was insufficient information on the status of the projects. An attempt was made to reach John Kibuuka, an ICT expert from Uganda, who has been a part a team that established telecentres in rural Uganda and Tanzania. The problem with external facilitation of ICT services that he identified was the sustenance of the service once the funds expired. The reason for the demise of these projects in his opinion was people do not see the project as their own. The projects are seen as a means to earn their daily bread. Hence there is a mismatch in the objectives of the recipients of the projects and the supplier of the infrastructure.

Based on these explanations, it was impossible to ascertain how the projects fared. But more on the interview with John will be mentioned in the course of the discussion of this research.

10.1.2 WHY UNIVERSALITY FUNDS

The rationale for using the vehicle of the Universal Service funding is because most African telecom regulators already understand how it works and it is widely adopted in Africa as a mean of achieving universal access. All sub-Saharan African countries have enacted universal service funding laws and few have set up operational Universal Service funds (see (ITU (a), 2013)). Some of the funds are operational and most are moribund (GSMA, 2013). In other cases, they have laws that establish a basis for a universality fund (World Bank, PPIAF, 2005).

However, despite these irregular implementation patterns towards Universal Service in Africa, the proposal of this report is a possible light bulb that could lead some of the inactive universality funds to become active. Nevertheless the ITU (a) (2013) highlights the various initiatives adopted towards the attainment of Universal Access and Service in sub-Saharan Africa. Hence one, by implication, could say that - aside allowing the forces of demand and supply to serve as a catalyst for rural development in the supply of mobile telephony- Universal service funds has been adopted in the development of National Information centres (telecentres) in Sudan, Nigeria, Ghana and Uganda; the provision of national fiber backbone in Mauritania, the provision of pay phones in Uganda; the development of last mile mobile infrastructure in Uganda, Nigeria, Ghana, Rwanda, to mention but a few (ITU (a), 2013). Most of these Universal Service projects are financed via subsidies accrued from contributions from the telecom companies and international donor agencies such as the World Bank (ITU (a), 2013).

These examples outline the potentials of Universality fund from the top to bottom approach. What would happen if there was a commensurate bottom-up approach to supplement these efforts in sub-Saharan Africa? This is yet to be seen.

Despite the existence of high Universal Access and Service activities in these 3 countries, at the moment, most of the activities are not focused on the delivery of High Speed Broadband infrastructure (except for Nigeria) as it is done in some Asian countries, a North African country and Mauritania as mentioned earlier. Mongolia, Pakistan and Malaysia are examples of developing countries in Asia where Universal Service funding has been used to finance the development of Broadband in underserved areas and rural areas (See (Yardley, Developing successful Public-Private Partnerships to FosterInvestment in Universal Broadband

Networks, 2012)). Mongolia and Malaysia are investing in wireless Broadband solution, while Pakistan is investing in the Fixed - Broadband solution (FTTH). In North Africa, Morocco in 2009 rolled out internet service via ADSL to 159 rural locations (ITU (a), 2013).

Hence, this research fills the gap by introducing another universal service mechanism as a supplement towards to the existing universal service funding, which already exists in Sub-Saharan Africa. It is important to note that this research does not imply in any way that Universal Service funding is the best way out. Rather, it was important to start the investigation from the known to the unknown from the established to the non-established to build. This provides a foundational basis for investigating the phenomenon. Secondly, whatever analytical solution is arrived at in this research is not intended to contradict the existing Universal service funding, but to make it better and more effective in reaching the rural people. If the current Universal service funding initiatives in all sub-Saharan African countries were effective in reaching the people in the rural areas, then this report would be futile.

10.1.3 RATIONALE FOR THE SECONDARY CASES

The cases in the secondary case study of this report are the cases where proposals adapted from the primary case study will be referred. The rationale for picking Nigeria and Ghana as representative nations is because of the high level of Universal Access funding activities in these nations compared to others, aside Uganda and Sudan who has equally high if not higher universal service funding activity as well (ITU (a), 2013). Secondly, the rural areas in these countries share similar characteristics with rural areas in other sub-Saharan African countries.

High Universal service Activity: Some Universal access and fund services in Africa, according to ITU (2013) such as Democratic republic of Congo, Gabon and Burkina Faso, among others have been identified as inactive. The sub-Saharan African countries with a higher activity identified in the same report are Sudan, Nigeria, Ghana and Uganda (ITU (a), 2013).

Similar rural Characteristics: It is necessary to note that rural areas differ and there is no standard definition for what is rural (see (Wiggins & Proctor, 2001)). However, in sub-Saharan Africa, there are basic features that separate areas that are not urban from the urban areas. A visit was made to some sub-Saharan African countries such as Nigeria, Togo, Benin and Ghana in West Africa in 2011. Another visit was made to Tanzania in East Africa in 2014. As part of the visit, there was an interaction with some of the rural dwellers at Kerege and Jaribu, in the central region of Tanzania. It was realized that the core rural areas in sub-Saharan Africa had similar characteristics. The similarities in the characteristics of the core rural areas were:

Economy: Most rural areas were agrarian communities with little or no commercial activity.

Income levels: The average income level, aside some exception, in these rural areas were less than 2 dollars a day.

Settlement: Settlement in these rural areas varied, in some areas; there were a close knitted community in a densely populated small acre of land. In other cases the population density was small and scattered over large acres of land.

Social Amenities: Some villages had shared basic amenities such as electricity and water supply, while some villages had nothing. The provision of the basic amenities depended either on the proximity of the village to the nearest town, the political will to supply the basic amenities or the deterministic will of the people to facilitate supply-pull. An example of the political will to supply is the case of the provision of Electricity to rural areas by the Rawlings Government in Ghana.

Topography: Most sub-Saharan African countries are home to thick rain forests, hills and Plateaus. In Nigeria, Ghana and Tanzania. Rural tribes live either on or around some of these hills. An example is the Ara village in Nasarawa Egon Local government located in the middle belt of Nigeria.

Sub-Saharan African countries also have differences as well with regards, tribe, culture, education (literacy), mobile network penetration, etc.. But these are not the focus of this report. That is not to say that these differences do not matter. They do matter, as it will be seen in the discussion later, but they were not strong enough to deter from picking representative nations

10.2 SECONDARY CASE 1 – UNIVERSAL SERVICE FUNDING IN GHANA

This section provides a description of universality funding in Ghana, the stakeholders of importance, how the universality funds are organized and financed. The description aids in identifying the PPIs in Ghana aimed at facilitating Broadband infrastructure and the implications of the findings.

10.2.1 BACKGROUND ON UNIVERSAL SERVICE FUNDING IN GHANA

The road towards universal access funding in Ghana has been facilitated by policies and initiatives aimed at promoting Universal access towards the development of fixed-line and mobile telephony. An Example of such policies and the funding initiatives included:

Public development of Payphones booths: The first conscious step towards the provision of Universal Access was the adoption of the 5 year (1994-200) Accelerated Development Plan (ADP) as a means of revitalizing the telecommunications sector (Frempong & Braimah, Assessing UNiversal Access to ICT in Ghana, 2008). Under the ADP, the vehicle of attaining Universal service was the provision of public and private pay phones in rural and urban areas (Boateng, 2012). Boateng (2012) further explained that the target of the 5 year plan was increased teledensity from the then existing 0.31% to between 1.5%-2.5%. There were other agendas on the ADP list such as the role of the then nascent operator, the NCA and the desire for the increase in mobile services. Unfortunately, the scope of discussion centers on Universality Funding. This means of universality funding was based on Ghana’s definition of universal access to be the availability of a telephone in every locality of 500 people (ITU, 1998). The number of pay phones deployed between 1993 and 2003, increased from 25 in the country to 6,921in the country respectively (Frempong & Braimah, Assessing UNiversal Access to ICT in Ghana, 2008).

Universal Service Obligations: Under the National Communications Regulation 2003, Universal access was defined as Universal coverage. Universal coverage referred to the entire geographical market, including rural, remote and low population density areas. To achieve Universal Access, the telecom network operators were granted Universal Service Obligations which would be within the licensed period. (Legislative Instrument sighted at (Invest in Kumasi, 2014)).

Telecenter Development: In 2003, Ghana launched the ICT for Development (ICT4D) policy (NCA, 2003). The goal of the policy was to create a roadmap that would lead Ghana to becoming an information and a knowledge based society. In this policy, Universal access to ICTS was identified as access to ICTs by every facet of society and the economy. The policy focused mainly on the supply side of the market, which in a nutshell outlines goals towards developing the necessary backbone infrastructure as well as the last mile and access infrastructure. The private sector was seen as a vehicle for investment. One of the supply initiatives included the building of multi-purpose telecentres.

Private Telecenters were established in Ghana as far back as 1992 (Falch, 2004). In 1997 there were about 50 to 60 telecentres in the greater Accra region alone (Mansell, 1997). In 2003, outside the Greater Accra region, the telecentres were found mostly in regional capitals. The existence of the then national former incumbent Ghana telecoms and the defunct Capital telecom (who were then mostly fixed line operators) in some of these district capitals was the driver for the existence of these few telecentres (Falch, 2004).

One would say that the existence of these private telecentres showcased the possibilities that exist towards the adoption and diffusion of ICTs, using the vehicle of telecentres in remote areas. In remote and rural areas, the ability to afford Customer Premise Equipment would be low; hence providing access via telecenters would be a worthwhile venture.

Public funding via Universality funds: From information gathered from documents provided by GIFEC, GIFEC (Formerly GIFTEL) was established in January 2004 as an implementing agency of the Ministry of Communications in Ghana. Their duties included the facilitation of the supply of ICT, internet infrastructure and connectivity to under-served and un-served areas of the country. Mention of GIFTEL and its functions are also mentioned in the Ghana Telecommunications Policy of 2005 (NCA, 2005).

In January 2005, backed by the Electronic Communications Act 775 of 2008, GIFTEL was renamed GIFEC and its mandate expanded to include the provision of access to electronic services including ICT, broadcasting, Multimedia, basic telephony and the internet to underserved and the un-served communities in Ghana.

Today GIFEC is seen as the agency that can close the access gap. They have embarked on numerous projects, which incorporate other universal service initiatives mentioned excluding Universal Service Obligations. GIFEC has been operating in partnership with different stakeholders. However, GIFECs activity towards the provision of high speed Broadband and NGNs in rural areas is low, hence this research. In this chapter, these relationships will be analyzed. It is important to note that there that Key stakeholders will be identified and described.

It is important to note that these are not the only ways that the Public sector in Ghana has adopted towards facilitating universal access. However, one would say that these are the identified intentional steps adopted by the Public sector in Ghana towards facilitating universal Access and Service. One major way Universal access has been facilitated has been via sector reforms. This has led to the telephony market development from a monopoly of one Company Ghana Telecoms (now Vodafone), to a market of 6 mobile, of which 2 of them are fixed line operators. The fixed line operators are Airtel and Vodafone. The mobile network operators are Airtel, Vodafone, MTN (Scancom Ghana), Tigo (Millicom Ghana), Expresso (Sudatel), and GlO. MTN commands a Market share of approximately 45% of the market, making them the Significant Market Power (NCA, 2014). The market has grown from 464896 subscribers in 2001 to more than 28 million mobile voice subscribers in January 2014 (NCA, 2014).

However, this report will focus on the agency that has the mandate to serve the unserved and under-served communities in Ghana.

10.2.2 APPLICATION OF STAKEHOLDER THEORY

Earlier on in this research, mention was made of the stakeholder theory. This theory is used to identify and describe the key stakeholder relationship with regards the facilitation of the Universal Access of ICTS in Ghana. A key stakeholder is the one in which an issue is important to (Savage, Nix, Whitehead, & Blair, 1991). They have influence upon or within an organization. They could be primary or secondary stakeholders. A primary stakeholder is “one or a group without whose continuing participation the corporation (firm) cannot survive as a going concern” (Clarkson, 1995). The primary stakeholders have to be kept satisfied. Clarkson (2005) also defined a secondary stakeholder as one, or “a group …who influence or affect or are influenced or affected by a corporation, but they do not engage in transactions with the corporation and are not essential to its survival.” They do not have to be kept satisfied.

Once the Key stakeholders are identified, the next step would be to apply the descriptive stakeholder theory to find out how GIFEC actually manages these stakeholders. In the identification phase, an attempt is made to group the key stakeholders as demand stakeholders, supply Stakeholders and Intermediary. The intermediary in this research is one that is a facilitator of either, demand, supply or both. The rationale for these exercises it to identify points where there are Public Private Interplays. At the descriptive stakeholder phase, the aim is to identify which of the stakeholders are really important to GIFEC and which of these stakeholders can they do without. Here it will be clear, which stakeholder has power, which stakeholder requires urgent attention and finally which stakeholder is legitimate (Mitchell, Agle, & Wood, 1997).

The understanding of these factors will help in the final analysis to understand which stakeholder either on the current demand and supply stakeholders can be considered in the final analysis and the stakeholder that may not be considered.

In the final section of this chapter, existing PPIs established in this case will be highlighted.

Stakeholder Identification: Data triangulation was adopted as a means of identifying the different stakeholders managed by GIFEC. The data triangulation method included the combination of purposive sampling techniques and the snowballing sampling technique. The stakeholders identified by the purposive sampling were represented in table 10.1.

Table 10- 1 Stakeholders Identified via Purposive Sampling

	Stakeholder	Function
1.	GIFEC	Universality Fund manager
2.	Communications Authority (NCA)	Telecom regulator
3.	Ministry of Communications	Sector ministry and Manager of GIFEC
4.	Parliament	Finances GIFEC

Source (Williams (2015))

These entities were already known to the authors of this report. The snowballing sampling occurred during an interview with the communications manager of GIFEC and other anonymous ICT experts in Ghana. The list of identified stakeholders is presented in table 10.2.

Table 10- 2 Stakeholder Identified via Snowball Sampling Techniques

	Stakeholder	Function
1.	*Internet Service Providers (ISPs)	Provide internet infrastructure and service
2.	*Telecom Network Providers	Provide telephony infrastructure and service
3.	Private Business entrepreneurs	Facilitate the delivery of ICT infrastructure for GIFEC
4.	ICT engineers	They are hired by GIFEC to build and maintain ICT infrastructure
5.	Media	They disseminate news about GIFEC to the general public
6.	Ministries, Departments and Agencies	They are recipients of GIFEC's infrastructure supply
7.	Local Government (Municipal and district Assemblies)	They are recipients of GIFEC's infrastructure supply
8.	Non-Governmental Organizations (NGOs)	They facilitate demand and supply of ICT to rural areas

9.	Educational Institutions	They are recipients of GIFEC's infrastructure supply
10.	State Security Agency	They are recipients of GIFEC's infrastructure supply
11.	International Donor Agency	They facilitate demand and supply of ICT to rural areas
12.	Fishermen	They are recipients of GIFEC's infrastructure supply
13.	Communities	They are recipients of GIFEC's infrastructure supply

Source (Williams (2015))

* The role of the ISPs and Network Operators in the provision of Universal Service of Internet and telephony respectively, are also spelled out in the Ghana Telecommunications Policy of 2005 (NCA, 2005).

The stakeholders in table 10.1 are organizational stakeholders, whereas the stakeholders in table 10.2 are black boxes or institutions. Each black box consists of different organizations and individuals. The reason for adopting black boxes is to make the stakeholder relationships easy to explain. The second advantage is because the members of each black box share the similar attributes with regards to function.

The identified stakeholders could be grouped as either Public, Private or civil society stakeholders as seen in table 10.3 below

Table 10- 3 Stakeholder Classification

Private Sector Stakeholder	Public Sector Stakeholder	Civil Society Stakeholder
Telecom Network Operators	GIFEC	International Donor Agency
Internet Service Providers	Ministry of Communications	Media
Telecom/ICT Engineers	State security Agencies	Fishermen
Private businesses/ Corporations	Other Government Institutions	Non-Governmental Organization
	Ministries, Departments and Agency	Communities

	National Communications Authority	Educational Institution
	Local Government agencies (Municipalities)	

Source (Williams (2015))

The stakeholders can also be classified from a market perspective where one can identify a stakeholder as a demand stakeholder and a supply stakeholder. In some cases a stakeholder could be both, in this can we identify such as an intermediary. This is because Universal Access is not possible if there is no supply and demand for of ICT infrastructure. In some cases, especially in rural areas where demand is either low or non-existent, intermediaries may be needed to facilitate demand or supply or both. Table 10.4 presents the supply stakeholders.

Table 10- 4 Supply-Side Stakeholders

Supply Stakeholders	Stakeholder role
GIFEC	Central stakeholder
Ministry of Communication	Supervising stakeholder
Parliament	Financing and supervisory partner
NCA	Partner stakeholder
Internet Service Providers	Permanent Technical and Financial stakeholder
Telecom Network operators	Permanent Technical, Financial and Management stakeholder
Telecom/ICT engineers	Temporal Technical Stakeholder
International Donor Agency	Temporal Financial and management stakeholder
Private Entrepreneurs and corporations	Temporal management stakeholders

Source (Williams (2015))

GIFEC’s constitutional duty is to provide supply push of ICTs into communities that are under-served and unserved. However, for them to push the supply they have to identify areas where ICT would be of benefit to the demand side of the market. In the course of the interview with the communications manager of GIFEC, it was clear that GIFEC supplies in three ways.

- They supply in collaboration with either a civil society agency stakeholder or public sector stakeholder. This implies that the civil society stakeholder or the public stakeholder has facilitated demand, hence partners with GIFEC to facilitate supply.

- Private businessmen come up with proposals that falls within GIFEC's mandate to fund. However, GIFEC will only fund the proposal if the entrepreneur can show an evidence of the universal access initiative deployed successfully elsewhere around the globe.

- GIFEC also supplies on its own initiative

On the demand side of the market, information gathered from GIFECs electronic portal indicates that the supply of ICT in the rural areas by GIFEC is dependent on perceived user need and not the actual user need. Hence the demand pull from the user end is either weak or non-existent. The weak demand is characterized by the lack of ICT readiness of Government institutions in rural areas (Gyaase P. O., 2014). The high level of illiteracy in the rural communities and a general lack of understanding of the potential of ICTs in their lives as rural dwellers are other plausible reasons for the weak demand (Boateng, 2012). These plausible reasons precede the impact of the income status of rural dwellers. The reason for the precedence is that if the targeted stakeholders in rural communities (excluding Government institutions in rural areas) are literate, then one would say that there is potential demand and the demand would be expressed if the purchasing power is available. However, if they are not literate then they will still not adopt ICTs, because they would not know how to use it.

It is important to note that aside stakeholders that also aid GIFEC in the supply of ICT infrastructure such as the telecom network operators, the individual stakeholders in each black box represented in table 10.5 are not permanent stakeholders of GIFEC.

Table 10- 5 Demand-Side Stakeholder

Demand Stakeholders	User needs	Stakeholder role
Ministry Department and Agencies	They need ICTs to advance their e-Government activities	Target beneficiary of GIFEC infrastructure
Security Services	They need ICT to better coordinate their security activities	Target beneficiary of GIFEC infrastructure
Fishermen	They need GPS and fish finders for their fishing activities	Target beneficiary of GIFEC infrastructure
Educational Institutions	They need ICT connectivity to facilitate educational capacity building	Target beneficiary of GIFEC infrastructure
Communities	They need Community Information Centres (Telecentres) to gain access to telephony and the Internet	Target beneficiary of GIFEC infrastructure
Local Government Agencies	They need ICTs to advance their e-Government activities	Target beneficiary of GIFEC infrastructure
Government Institutions	Institutions such as the post office, Library etc. need telephony and internet connectivity to carry out their daily duties	Target beneficiary of GIFEC infrastructure
Telecom network operators and Internet Service Providers	They can share infrastructure to enable the penetration of telecom and internet infrastructure in rural areas	Target beneficiary of GIFEC infrastructure

Source (Williams (2015))

As mentioned in earlier in this section, these stakeholders facilitate demand or supply or both. Table 10.6 presents these stakeholders. These stakeholders are not permanent stakeholders with GIFEC. They are still important as they aid in facilitating demand and supply of ICTs to rural areas.

Table 10- 6 Identified Intermediary Stakeholder

Intermediary Stakeholders	Function	Stakeholder role
International Development Agencies	They propose projects to GIFEC in partnership with a government agency for the benefit of rural dwellers	intermediary
Media	They disseminate information about GIFEC activities	intermediary
Non-Governmental Organization	They court GIFEC or are courted by GIFEC to serve or manage ICT services in rural areas	intermediary
Ministries, Department and Agencies	They form cooperation that align with GIFEC to supply ICT services in institutions	intermediary

Source (Williams (2015))

In an attempt to map the relationships between the stakeholders, it was important to further place the existing black boxes into a new black box, categorized by the market stakeholders as seen in figure 10.1 below. This was because as seen in the tables in this chapter, some stakeholders are not just demand or supply stakeholders, but also fall into the class of Intermediary stakeholder.

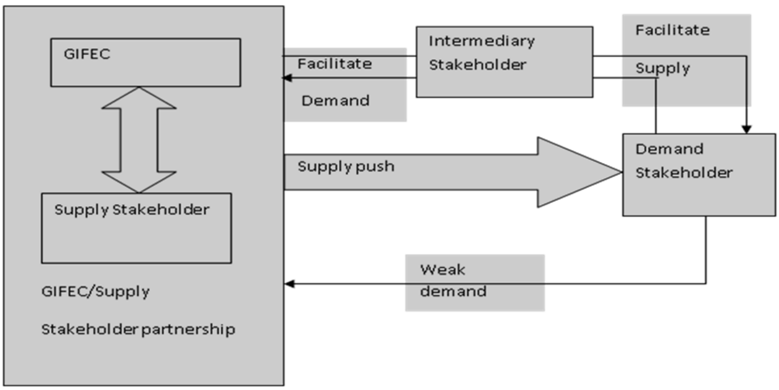


Figure 10- 1 ***GIFECs relationship with their Stakeholder***

In the next section, how GIFEC relates to these stakeholders will be discussed.

Stakeholder Relationships and Functions: From the normative stakeholder theory point of view, the philosophical guidelines for GIFEC's operations are formed not by law (by the Electronic communications Act 775 of 2008). Hence GIFEC does not have the luxury of choosing a stakeholder that is not permitted by law, no matter how effective that stakeholder would be. Based on this constraint the stakeholder relationship is also shaped. The rationale for describing the relationships of the stakeholder to GIFEC is to grant legitimacy of the identified key stakeholders to GIFEC. Although Parliament provides finance for GIFEC, they are not key stakeholders that are why much is not said about them in this report. Let us look at each relationship one by one.

Table 10- 7 GIFEC's Relationship with their Stakeholders

	Stakeholder	**Stakeholder Function**
1	GIFEC and Ministry of Communications	By the law, GIFEC is an agency of the Ministry of Communication (MOC, 2014). GIFEC is the Universal Access implementing agency of the ministry, which implies that GIFEC's activities, is done on behalf of the ministry of communications. As gathered from the interview, the ministry appoints the officers of GIFEC; hence GIFEC owes its loyalty to the parent ministry. As seen in table 10.4, the ministry is the supervising stakeholder. However, it is important to note that GIFEC is autonomous in its operations, but cannot operate outside its mandate. Be that as it may, the ministry is a Primary stakeholder in GIFEC and it manages GFEC through the GIFEC board.
2	The NCA	GIFEC is a sister agency to the NCA, the national regulator. Both agencies collaborate during workshops aimed at creating awareness for ICT initiatives and in the deployment of ICT infrastructure. The NCA allocates spectrum for GIFEC infrastructure. The agency is also represented on the GIFEC board of trustees.
3	ISPs and Telecom Network Operators	They are major partners with GIFEC on the demand side of the market, as they are managerial, financial and technical partners of GIFec. During the interview with the GIFEC communications manager, it was explained that the ISPs and Telecommunication Network Operators contribute 1% of their annual income towards the operation of GIFEC. This act is facilitated by the Ghana Telecommunications Policy of 2005 (NCA, 2005). He further explained that by law, each of the telecom network operators has a representative on the GIFEC board. One would say that the telecom network operators and the ISPs are the sustaining thread of GIFEC. These telecom companies (Scancom Ghana (MTN), GLO, Expresso, Millicom (Tigo), Vodafone and Airtel) are bound to GIFEC by the Electronic Communications Act 775 of 2008 and not by

		their choosing (See (NCA, 2008)). However, these stakeholders have an interest in what GIFEC does because GIFEC's activities could be in conflict with the interests of these network operators and ISPs. However, this is not the reason they are members of the GIFEC board. Still on the supply side, GIFEC also provides subsidy to the telecommunication operators who engage in Universal Access Projects. On the supply side of the market, GIFEC has provided microwave mast with antennas in rural areas for the Common Telecommunication Facility Project (Collocation). Another project in which the facility operators are beneficiaries of, is the rural telephony project. Here a self supported mast, powered by solar panels is provided in rural areas for telecom companies to use. 19 of them are operational at the moment and work is ongoing at 9 more sites. The idea behind this project is to absolve some of the cost of the telecoms operator incurred towards providing mobile telephony serviced in rural areas. For the collocation program, GIFEC is planning to bring the private sector on board
4	Telecom/ICT Engineers	This is a form of service contracting embarked upon by GIFEC. Here the ICT Engineers are hired by GIFEC to build an ICT Facility or the ICT Engineer could be working for an ICT company that is hired to develop the GIFEC infrastructure.
5	Private Entrepreneurs	They are often hired by GIFEC through via a procurement procedure to develop GIFEC infrastructure. The project is often fully funded by GIFEC.
6	International Donor Agencies	International Donor Agencies have partnered GIFEC towards facilitating the supply of ICT to rural farmers in Ghana. An example is the partnership between GIFEC and USAID in the development of the Last Mile initiative project. USAID is involved in the development of Agriculture in Ghana as Ghana is a focus country of the US Governments Feed the Future initiative. The partnership between GIFEC and USAID enables the use of ICT to achieve USAIDs agricultural development activities in Ghana. USAID also facilitates demand for the infrastructure by mobilizing the farmers.
7	Ministries, Department and Agencies (MDAs)	These government agencies are target beneficiaries of GIFEC infrastructure in rural areas. GIFECs infrastructure in conjunction with the private network operator infrastructure provides mobile network connectivity to the outlet of the government agencies in remote and rural areas. Such initiatives include the Community Information Centres (telecentres) rural telephony project and the collocation project, the library connectivity project and the Post Office

		Connectivity project. In order to spur demand, GIFEC embarks on ICT capacity training workshops for District information officers. GIFEC also identifies the MDAs as partners. As GIFEC targets municipalities and districts in Ghana with Community Information Centers. The Ministry of Communications and the United Nations Development Program (UNDP) share cost in the building, operations, management and capacity building for the Community Information Centers. The Ministry of Information on the other hand via the Information service department are connected to the CICs to facilitate Government to citizen interaction. The CICs also serve as information hubs for the MDAs. The partnership between GIFEC and the Ministry of Agriculture is mentioned later in this section of the report.
8	Security services	GIFEC is also involved in the facilitation of demand for the security services. This is done via capacity building as well as the provision of customer premise equipment such as routers, desktop computers, printers, mobile phones, etc. These agencies are also expected to have access to Internet connectivity facilitated by GIFEC or from a private telecom network operator or ISP. GIFEC has channeled most of its effort in this regards towards the prison connectivity project. Here they provide Internet services in the prisons train both the inmate and Prison staff as well as supply Customer Premise Equipments.
9	Fishermen	GIFEC in partnership with the ministry of Agriculture and the Ghana Canoe Fishermen Council have embarked on a project to provide echo sounders and fishing devices that will easily locate fish in the ocean. This project is aimed at eliminating light fishing in Ghana. Here GIFEC provides funds for the project and is not engaged in facilitating demand. So far 200 fishermen have been supplied with the equipment.
10	Educational Institutions	Educational Institutions are also recipients of the GIFECs school connectivity project. Here GIFEC facilitates Internet connectivity to the schools (Tertiary, Secondary and Primary) as well as supply the schools with the Customer Premise Equipment. The project is carried out in partnership with the Ministry of Education. The ministry of education provides the list of the beneficiary schools to GIFEC, identify personnel for training, appoint managers for the management and maintenance of the project as well as lead the monitoring and the evaluation of the project.
11	Non-Governmental Organizations	Local NGOs just like the International Donor agencies have served as intermediaries between GIFEC and the local communities as well as target beneficiaries of GIFECs infrastructure. NGOs in rural areas

		participate as operators of Community Information Centers in Ghana, facilitating telephone and Internet connectivity via GIFEC's infrastructure. In the Library connectivity project, NGOs are not really on board, but GIFEC identifies them as organizations that can support the work of GIFEC. As intermediaries, local NGOs have served as partners with GIFEC towards the extension of ICT services in rural Ghana. An example of an NGO facilitating demand and supply is the case of a renewable energy in Ghana called The Kumasi Institute of Technology and Renewable Energy. The Kumasi Institute of Technology and Renewable Energy have had to partner with GIFEC toward the development of the Easy Business Centers Project. The project was implemented within 3 years (2009-2012). This project is aimed at harnessing e-business ventures in rural areas to spur up demand for ICTs. The prospective entrepreneurs are to develop and operate e-powered business centers, which will provide telephone, Internet and value added products and services. GIFEC provides the seed capital for the prospective venture while the Kumasi Institute of Technology and Renewable Energy helped in setting up the renewable energy facility for operating the business center. The NGO facilitated supply as the idea came from the NGO. An extension of the Easy Business Centre project is the collaboration between the National Council on Persons with Disabilities (NCPD) and GIFEC called The Disability Employment Project. The Disability Employment Program involves the establishment of small business centers for people with disabilities to sell telecom accessories for mobile phones in rural areas. GIFEC was responsible for the financing, building and maintenance (for a year) as well as provide ICT training for the participants. The NCPD was responsible for coordinating the disabled and identifying potential beneficiaries as well as the location of the business kiosks. International NGOS such as the UNDP as mentioned earlier have jointly financed the Community Information Centers, meant for rural dwellers. They have also partnered GIFEC in capacity building such as the training of District information officers and the Community Information Centre managers. GIFEC hopes to co-opt them into the Last Mile Initiative Project.
12	Municipalities and districts	Municipalities are identified by GIFEC as beneficiaries of the Community Information Centre Projects, so far 99 municipalities and districts are connected to these ICT centres and the District Information Officers are municipality officers, which represent the ministry of

		Information at the Municipality or district level. Municipalities and districts are not involved in the supply of ICTs to their domain.
13	Communities	This is either remote, rural, unserved or underserved areas in Ghana. This is GIFEC's primary demand stakeholder. One would say that the other demand stakeholders are agents for demand aggregation to spur up these local communities. In Ghana the communities or villages are usually ruled by traditional rulers, supported by a traditional council. Some communities are large enough to support sub-communities lead by sub-traditional rulers that bear allegiance to the paramount traditional ruler of the enlarged community. In reality some the enlarged communities are actually ancient Kingdoms, such as the Ashanti Kingdom, and many others. Most of these kingdoms are made up of urban and rural areas. An example of the urban areas is Kumasi in the Ashanti Kingdom. However, in the Ashanti region, there are villages such as Kokofu in the Bekwai municipality with local traditional rulers subject to the Ashanti King. Hence there is an organized structure that runs from the head of the enlarged community to the smallest sub-communities. GIFECs operations in the community are mostly ICT infrastructure supply. They collaborate with the various public agencies, chiefs and their local councils who aid in the facilitation of demand. The projects aimed at ICT Infrastructure and Service supply of ICTs include the Rural Telephone Project, The rural Payphone project, Community Information Centers, Easy Business Centres Project, Last Mile Initiative and the Disability Employment Program. In facilitating demand in communities, GIFEC has established the Community Initiative projects. The initiative involves the establishment of ICT training centers, Data from documents provided by the GIFEC communications manager indicate that 150 communities in the country are beneficiaries of these centers. The centers are provided to schools. The schools are supported with college management software imitated by GIFEC that would those coming to learn. GIFEC is also working on delivering such initiatives to traditional councils as well and the general public.
14	Media	They are indirect intermediary stakeholder that indirectly facilitates demand and supply of GIFEC via information dissemination. Potential demand is possible if people in rural areas are sensitized about GIFEC activities and the use of the telephony and Internet. The potential supply is possible if an NGO, International Donor Agency or a Private entrepreneur gets to hear about GIFEC and its activities via a media

	outlet. This provides the potential supplier with ideas of how their norms and values of their organization to match that of GIFEC and proceed to collaborate to supply.

Source (Williams (2015))

10.2.3 STAKEHOLDER SALIENCE IN GIFEC'S RELATIONSHIP WITH STAKEHOLDERS

The next process would be to identify which stakeholder has power, which stakeholder requires urgent attention and finally which stakeholder is legitimate. The stakeholder theoretical guide here will be Mitchell, Agle & Wood (1997).

Power Stakeholders: Based on the Stakeholder Saliency theory, as explained in the section 8.2.3.2, the definition of Power the potential for "operationalization" as the attempt in this section will be to identify actors that can get another actor to do what they would not do. Power could be variable or a stable state. Mitchell, Agle & Wood (1997) did identify power as a variable state. However, in this report, it is construed that power can be static (latent) or dynamic. In cases where steady powers are granted by regulation, a stakeholder may have a steady power until circumstances changes.

- Stakeholders with Stable Power: There are two forms of stable stakeholders identified in this case. This is the stakeholder with Stable power that is expressed. Steady power in this case is derived from management and Obligatory Financial contribution. The second is the stakeholder with latent stable power. Here the stakeholder is capable of influencing decisions, but does not use its power.

Table 10- 8 ***Types of Stakeholder with Power***

Type of Stable Power	**Stakeholder**	**Stakeholder Power Description**
Stakeholders expressed stable power	GIFEC Board Management Stakeholder	Based on the Electronic communications Act 775 of 2008, the trustees of GIFEC or the board of trustees set GIFEC's agenda and the administrator of the fund will follow these directives. The trustees receive their directives from the minister on matters of policy. The act grants the minister's powers over the trustees and the trustee's power over the GIFEC administrator. The duties of the trustees as stipulated by the law are expressed in the box 10.1 below
	Stakeholders with Obligatory Financial Commitment to GIFEC	The power accrued here by these stakeholders is not necessarily as a result of the obligatory financial contribution. This is because financial contribution without a stake in the enterprise constitutes to a gift. However, some stakeholders who are mandated by law as members of the board of trustees are also obligatory financial contributors. These are the network operators and the Internet service providers. Based on the powers they enjoy as being trustees, they also get to decide what the funds should be used for as well
Stakeholders with Latent Power	Communities	In the case of a strong demand pull, the communities would obviously exhibit coercive powers either overtly or covertly in extreme cases. This would make them dangerous stakeholders. However, in a more decent way, their power could be utilitarian, if they have the resources to back their display of power towards achieving maximum utility from ICTs in their community. On the other hand, their power could be normative if these communities organize themselves towards developing ICT and decide to partner with GIFEC to achieve this purpose. On the normative level, both parties would share similar norms and values with regards ICT diffusion and adoption in rural areas in order to work together.

	However, at the moment, the communities still possess this power as the setting up of GIFEC was because of them. But this power is latent at the moment because it is not being utilized and this is where the solution proposed by this report becomes significant.

Source (Williams (2015))

Box 10- 1 Function of GIFEC's Trustees

Pursue policies to achieve the object of the Fund;

Collect or arrange to be collected moneys lawfully due the Fund;

Account for the moneys in the Fund;

Determine procedures for disbursement of the Fund and disburse the Fund;

Monitor the utilization of moneys disbursed by the Fund;

Invest the moneys of the Fund in safe securities that the Board considers financially beneficial to the Fund; and Perform any other function incidental to the achievement of the object of the Fund.

The trustees of the fund include a chairperson, the administrator of the fund, a representative of NCA (the telecom regulator), a member of the parliamentary select committee on communications, a representative of the ministry of communication and 6 representatives of the industry (reps of each telco). The ISPs are represented by the head of the Ghana Internet Service Providers Association (GISPA). The power exhibited here is normative. This is because the powers are derived by-law.

Source: Electronic Communications ACT 775 of 2008

- Stakeholders with variable powers: The powers of these stakeholders are not etched by law, rather they are utilitarian in nature, temporary and variable. Their powers are not defined, but determined by situations. The utilitarianism approach stems from the fact that the stakeholders believe that the course of action that will be proper and result in the increase in utility and reduction in rural poverty is the provision of ICTs in rural areas. To achieve this belief they partner GIFEC by contributing financial resources to achieve this utilitarian ideal. As described earlier, these are the NGOs and the International Donor Agencies.

Urgent Stakeholders: On the issue of urgency, the Stakeholder salience theory identifies the urgency claims coming from the stakeholder. The theory also makes room for other cases where the manager decides which stakeholder deserves urgent attention and which stakeholder does not. In this sense the stakeholder can be identified as a potential stakeholder with the attribute of urgency which is presently dormant. Urgency in this sense denotes a claim where the relationship is important to the stakeholder or the manager cannot do without.

The Electronic communications Acts 775 of 2008 is used as an inspiration for extracting stakeholders with urgent claims. The first set of stakeholders with urgent claims are the core recipient of GIFECs actions From the Electronic communications act 775 of 2008, section 42, sub-section 6 identifies the prioritization of projects. This provides a glimpse into the stakeholders with urgency as will be seen later. The act states thus:

The order of priority for support from the Fund are as follows:

Projects that are established to provide basic telephony service to rural areas;

- Projects for the establishment of access to value-added services including introduction of internet points-of-presence in a district.

- Other projects that the Minister may designate as priority projects.

Based on this priority list, projects aimed at extending Telephony and the internet to rural areas and districts are priorities of the fund. Hence, the stakeholders with high claims to urgency are the ‘black box’ communities. These include rural areas, remote areas, unserved and underserved areas.

The second set of stakeholders with urgent claims is those stakeholders without which, the activities of GIFEC would not proceed smoothly. To facilitate these rural projects, there are stakeholders that can serve as a vehicle to facilitate demand and supply of the priority projects thereby reducing the weight of GIFEC’s commitment. These stakeholders as identified earlier in this chapter are the parliament, Telecom Engineers, Private entrepreneurs, Network operators, and ISPs. GIFEC can do without the NGOs and International Donor agencies as exhibited in the list of projects mentioned earlier in this chapter.

The stakeholders with low claims of urgency are the fishermen, the educational institutions, municipalities/districts, and Government institutions (security services etc.), Library. Their urgency ranges from low to non-existent. The reason for the low urgency is because they are a means to an end – through them GIFEC can aggregate demand for the communities. Section C of the act quoted above that gives room for them as an afterthought, one might say. GIFEC can do without them.

Legitimate Stakeholders: The "operationalization" of legitimacy as defined by Suchman (1995) can only occur if the "socially constructed systems of norms, values and beliefs" are defined. In a situation where these values, norms and beliefs are divergent, blurry, vague and subject to any interpretation, then identifying legitimacy becomes a problem.

Mitchell, Agle & Wood (1997) identify legitimacy as a variable instead of a steady state. This report agrees with this assertion as legitimacy, although it adopts the normative theoretical approach of stakeholder theory, is case and situational dependent. It varies. This may not be good for a theory, if a universal standard for empirical analysis is to be conducted. However, it provides flexibility for the observer of a phenomenon to decide what is legitimate or not based on the case described.

Based on this flexibility, effort has been made in this report to do away with the attempt to identify the beliefs and values driving GIFEC and the respective stakeholder. Rather the effort is now placed on identifying legitimacy of a stakeholder to demand or supply ICT services under GIFECs management in the eyes of the Electronic communications Act 775 of 2008. In other words, the legitimacy is based on the moral claim backed by the reference act. The stakeholder, whose provision is catered for in the act, has moral claims as a stakeholder.

The subject of legitimacy for this research is the legitimacy to be providing ICT infrastructure or to be provided for with or by GIFEC respectively. This act identifies clear guidelines and norms of what the fund is about, who should be involved, who should supply and how the fund should operate.

The stakeholders identified in the act are Network operators, ISPs, GIFEC Board of trustees, and Ministry of communications, NCA, parliament (via parliamentary select committee), and Communities (rural areas).

This does not imply that other stakeholder groups cannot claim legitimacy at any point in time. If legitimacy is being viewed from Suchman's (1995) perspective, then any of the identified stakeholders or current non-stakeholders could wake up one day to say the usefulness of ICT – Utility- can be maximized if the stakeholder is permitted to deploy ICT in rural areas. GIFEC the manager of this ecosystem would then juxtapose its norms as defined by legislation and the norms guiding the potential legitimate stakeholder. If they match, then the legitimate claim is established. If they do not match, then the legitimacy claim is not established. An example, could be an organization that decides to deliver agricultural pitch forks to rural areas and expects GIFEC to fund it. Although the provision of the pitchforks will aid in maximizing the agricultural cultivation process, it has not thing to do the ideal standard or normative stands expected of GIFEC from the Ministry of communications and by law.

Hence stakeholder salience increases as GIFECs ideals matches that of a stakeholder claiming legitimacy. In this manner the normative stakeholder theoretical approach is adopted as it deals with morals, values and ethics. Then what is legitimate within this bounded normative idea will be utilitarian in nature.

However, at the moment, there has been no claim of legitimacy from the stakeholders on GIFEC as GIFEC at the moment is open to accepting key stakeholders that exist in rural areas without a claim of legitimacy. In an interview with the communications Director of GIFEC, he pointed out that anyone who has a good initiative that will help GIFEC fulfil its mandate is always welcome. He however did not imply that every idea will be adopted. Still, one would say that there is reduced claim for legitimacy as GIFEC is already in partnership with a whole range of stakeholders. These stakeholders include NGOs and International donor agency.

For purposes of clarity and proper guidance for the analysis, the legitimacy adopted here are based on the norms stipulated by law. However, for NGOs and International donor agencies based on their importance to the research in the discussion and analysis section, they are being mentioned now.

Having identified the various attributes, it is important to identify the definitive stakeholders. The table below represents the attributes. GIFEC is a definitive stakeholder and the manger of the Universality funding ecosystem; hence it is not included in the table.

Table 10- 9 Stakeholder Classification (Ghana)

	Power	**Urgency**	**Legitimacy**	**Stakeholder**	**Stakeholder class**
Communities	-	-	-	Definitive	Definitive
Ministry of Communications	-	-	-	Definitive	
Network Operators	-	-	-	Definitive	
ISPs	-	-	-	Definitive	
***Parliament**	-		-	Dominant	Expectant

NCA	-	-	Dominant	
International Donor Agency	-	-	Dominant	
NGO	-	-	Dominant	
Telecom Engineers	-		Demanding	Latent
****Private Entrepreneurs**	-		Demanding	
****Fishermen**	-		Demanding	
****Educational Institutions**	-		Demanding	
****Municipality/District**	-		Demanding	
****Government institutions**	-		Demanding	

Source (Williams (2015))

*

** low urgency

The extrapolation made so far indicates that 3 classes of salient stakeholders can be identified in the Ghanaian Universality funding echo system at present. These include the Latent stakeholder, the Expectant Stakeholder and the Definitive stakeholders.

Definitive Stakeholders: The definitive stakeholder with dormant powers here is the community. The other identified definitive stakeholders are a group of powerful Public and Private sector representatives who are incidentally in members of the GIFEC board. They do not have dormant power. The advantage of this set up is the cross fertilization of ideas, the disadvantage of the setup is the issue of conflict of interest they Network operators may face in making decisions. They naturally would not sanction any activity in the rural area that is against their interest. In the case of the NGOs and International Donor agencies, they have actually made demands and their demands were adhered to by virtue of the resources they brought to the table.

Expectant Stakeholders: The expectant stakeholders here are dominant stakeholders. They possess power and legitimacy. They are legitimized legally and from shared values with GIFEC aimed at deploying ICTs in rural areas. Their specific areas of operation may differ. However, they do not require urgent attention from GIFEC, hence the absence of urgency on the side of GIFEC towards them. However, if they shifted from being secondary stakeholders to becoming a primary stakeholder either by legal facilitation or realignment of Vision, they could warrant urgency, making them definitive stakeholders.

Latent Stakeholders: The latent stakeholders here do not matter as they are demanding stakeholders. They lack power and legitimacy, but GIFEC grants them urgency as a means of getting into the rural community. This places them on the demand bracket for now. Their status could change in future.

10.2.4 CURRENT ORGANIZATION AND FINANCING ARRANGEMENT OF GIFEC GHANA

The relationships between GIFEC and its stakeholders indicate that GIFEC is open to various forms of Public private collaboration aimed at deploying ICTs in rural areas. However, it is clear that the relationship between GIFEC and other stakeholders are constrained by legislation. However, GIFEC in the bid to carry out its activities has granted urgency to latent stakeholders that are neither powerful nor legitimate. They are not ignored. This is because of the proximity of these stakeholders in rural areas, served and underserved areas. One would say that this is a pass mark for GIFEC.

However, on the flip side of the coin, GIFECs universal Access activities seem to shy away from providing high speed Broadband to rural areas. One would say, not from GIFEC, but from observation that the network providers being granted definitive stakeholder status by law impedes GIFEC from going into more ambitious projects in the rural areas. Secondly, it is also a bit difficult to understand how GIFEC would compel the network operators to use GIFEC infrastructure if the network operators fund GIFEC. This is just a hypothetical pondering.

In the process of examining the data gathered from GIFEC, it was also glaring from their activities that GIFEC granted some powers to International Donor agencies and NGOs. Although these agencies are not granted powers by law or require any urgency, one could identify projects facilitated by these agencies that led to GIFEC funding it. This implies that GIFEC in managing its legitimate stakeholders is open initiatives that will aid in its mandate.

Based on this assessment, one would say that GIFEC is flexible to adopt new initiatives aimed at assessing Universal Access to ICTs. This is also in part because GIFEC is autonomous. Also based on this assessment one would say that GIFEC is willing to grant increased or reduced salience to stakeholders that shares its norms. GIFEC desires more participation from NGOs in its activities, hence it is the hope of this research to provide an inspiration for such an organizational possibility using PPIs as discusses in this report.

The implication of this assessment indicates that a good community based initiative proposal would be funded by GIFEC based on its relationship with the private sector using PPIs.

10.2.5 IDENTIFIED PPI

In most projects as mentioned earlier in section 10.2.2, GIFEC's supply initiatives as well as demand facilitation initiatives were facilitated by collaborations. The collaborations include PPIs, Public/public Civil Society partnership and general collaborations.

PPIs: In the Development of ICT/Telecom infrastructure, the following PPIs can be identified, namely Public DBO (a variant of PPP) and service contracting. The Public DBOs is cooperation between the Telecom Network Operators and GIFEC. The infrastructure is developed and owned by GIFEC while the telecom network operators rent the infrastructure to deliver their services for a contracted period. The projects include the Common Telecommunications facilities project and the Rural Telephone Project. The service contracting is the second way GIFEC deals with the private sector is via service contracting. Here either private companies bid for the delivery of GIFEC services or GIFEC contracts out its service to Telecom/ICT engineers.

Public/Civil Society partnership: These collaborations involve the partnership between the public sector and international NGOs. The international NGOs that have collaborated so far with GIFEC are owned by the United Nationa (UN) or country donor funding agencies. The most prominent as gathered from the GIFEC website is the United Nations Development Program (UNDP). The most prominent collaboration which is a pure ICT project is the cost sharing agreement between UNDP and the Ministry of Communication where both parties share cost towards building the Community Information Centers. Unfortunately, this is not a PPI as the private component in the facilitation of the project is missing.

General Collaborations: The point of departure of some of these collaborations is that these collaborations are not pure telecom or ICT collaborations. In the case of projects such as the last mile initiatives, the Easy Business community initiatives, the fishing project, and the disability employment project, GIFEC provide the ICT/Telecom component of the projects, while the other partners provide other components of the project. In such cases, funding for the ICT component emanates from GIFEC. Based on these examples, if the ICT/Telecoms components of such projects are detached from the main project, then the ICT/Telecom project would be pure public funding – as GIFEC is a public agency.

The level of infrastructure facilitation via PPI is low in Ghana

10.2.6 IMPLICATION OF FINDINGS

Based on the findings made from GIFEC, the following deductions were made:

- Ghana's Universality funding ecosystem is dynamic. Based on this fact GIFEC has the potential to partner communities towards facilitating bottom up Broadband development in rural Ghana to bridge the access Gap. The dynamism of GIFEC is not inherent in its organization, rather it has been made possible by funding possibilities from the contributions from the Telcos, the money from parliament and in many cases direct infrastructure financing from the ministry of communications. These financial possibilities give GIFEC the leeway to handle multiple infrastructure projects simultaneously, hence expanding its stakeholder base.

- GIFEC from the community initiative project has already identified the importance of the social structures of rural area towards the development of ICTs. In the proposal for Community Initiative Project, the traditional councils are seen as beneficiaries of the project. Having the experience of dealing with the local council is a Plus for GIFEC as it grants it the ability to mobilize this base if need be. Hence, they can facilitate demand and supply.

- GIFEC also understands that it needs help from NGOs and private sectors funding to enable it carry out its duties.

- They are still looking forward to adopting a PPP.

- They give room to both permanent stakeholders as well as temporary stakeholders.

- GIFEC has been yet to embark on the development of High Speed Broadband infrastructure in rural areas.

What is not clear though is that it is not clear if the GIFEC board of trustees would embark on PPIs aimed at developing Broadband Internet in rural areas. This is because in a sample study carried out in conjunction with this research carried out by Williams and Gyaase (2013), it was clear that ISPs are not interested in investing in rural areas in Ghana unless there was some public intervention (Williams, Gyaase, & Falch, 2012). The mobile network operators shared the same sentiments. However, some of them had provided mobile internet in rural areas, but with the 2G standard. But with the board consisting of network operators and ISPs, would conflict of interest permit them to grant GIFEC the right to facilitate Broadband Internet in rural Ghana? This is yet to be seen. However, based on the interview with the GIFEC communications manager, he stated that GIFEC was open to adopting new ideas of ways of facilitating the development of ICTs in rural areas but only if there is a model that has been practiced elsewhere. This implies that a sound argument from this thesis made on from the primary cases has the possibility of being adopted.

10.3 SECONDARY CASE 2- UNIVERSAL SERVICE FUNDING IN NIGERIA

This section provides a description of universality funding in Nigeria, the stakeholders of importance, how the universality fund is organized and financed. The description aids in identifying the PPIs in Nigeria aimed at facilitating Broadband infrastructure and the implications of the findings.

10.3.1 BACKGROUND ON UNIVERSAL SERVICE FUNDING IN NIGERIA

The universal access funding in Nigeria just like in Ghana has been facilitated by policies and funding initiatives aimed at extending telecom and ICT services in rural areas. Just like other African countries, the Nigerian Government had made huge investments towards the development of telecommunication infrastructure, right from the pre-colonial days till date (See (Ajayi, Salawu, & Raji, 1999)). The nation, guided by 5 different development plans (1960, 1970, 1975 to 1980, 1975 to 1980 and 1980 to 1985) had set up ambitious targets towards the level of adoption of telephony services but has always fallen below the target. However, the setting of these targets cannot be seen as an attempt towards Universal Access as considerations were not made towards the affordability of the telegraph and telephony infrastructure and services being provided. The targets for the development plans were mainly to kick start and grow the Nigerian economy and the provision of telephony to facilitate commerce was one of the infrastructure development goals on the table (See (Chete, Adeoti, Adeyinka, & Ogundele, 2014)). However Universal Nigeria did not really take steps in terms of policy and strategy towards attaining Universal Access until the National regulator, the National Communications Commission, was established in 1992 and the subsequent establishment of the Universality fund (Universal Service Provisional Fund (UAPF)) (See (Ige, 2003) and (NCC, 2014)). NITEL, the former national monopoly did attempt to promote universal service by providing connectivity to phone booths in the city, in areas where the teledensity was low as well as providing telephony access at rural post offices. The telephones in the rural post offices did not last and most remote post offices had not connectivity as their proximity to the nearest distribution point in the city was kilometers away. Most of the telephone booths became inactive as the rate of patronage for the booth was low due to the then high call tariff. Telecentres also existed in Nigeria, but quite unlike the case of Ghana, where there were attempts at the public to create these telecentres, Nigerian telecentres were mostly private initiatives or the initiatives of non-Governmental organizations.

However, in recent times, Nigeria has been funding universal service in various ways. This includes the Universal Service funding, the National Rural Telephony Project, wire Nigeria project and the State accelerated Broadband initiatives.

The National Rural Telephony project is a unit under the Federal Ministry of Communication Technology mandated to facilitate the extension of telecommunications infrastructure in rural areas. The project began in 2001 and in 2006, a phase of the project was leased to mobile network operators to manage and own on a Public DBO form of PPP (Vanguard, 2014). The project is still ongoing.

The Wire Nigeria Project is an NCC effort to provide Broadband connectivity to rural underserved and unserved areas across the country. The NCC provides subsidy to the successful bidder for the project (Pyramid Research, 2010). The State Accelerated Broadband Initiative is aimed at terminating fiber optic connectivity in every state capital in the Federation (Pyramid Research, 2010). Although one would say that The effort towards the delivery of high speed Broadband in Nigeria is feverish, these efforts are mostly backhaul connectivity efforts by the NCC to complement Universal service funding aimed specifically at rural, underserved and un-served areas.

Universal Service in Nigeria has been facilitated via direct and indirect funding via the instrument of the national regulator. The National Communications Commission was born out of the institutional reform facilitated by Nigerian Communication Commission act of 1992 (amended in 1998) to facilitate a market driven telecommunications industry and to promote Universal Access ((NCC (a), 2014) (Laws of the Federation of Nigeria , 2000)). These Acts were repealed and replaced with the Nigerian Communications ACT, 2003 Act number 19 (sighted at (NCC (a), 2014)). The act reorganized the NCC act of 1992 and granted NCC the mandate to regulate Universal Service. Their responsibility towards universal service was to design, manage, and implement universal service strategies and program in accordance to the policies and objectives of the Federal Government (Chapter 2, subsection 4(r)).

Indirect funding: An example of an adopted by the NCC has been the facilitating of universal service by t granting Unified licenses to the former ISPs and the existing telecommunication operators, as a way of expanding the market (Williams & Kwofie, 2014). So far 18 operators provide internet and telephony services with the unified licenses. This has led to smaller network operators extending mobile coverage to areas where the major network operators would not invest. Another major initiative has been the liberalization of the telecommunications market.

Direct funding: Aside the initiatives mentioned earlier, where the NCC funds, except the Rural Telephony project funded by the Federal Government, The National communications ACT, 2003 section 114, provided an agency (a fund) that will enable NCC facilitate the direct funding of Universal Service in Nigeria. The agency is the Universal Service Provision Fund (USPF). As mentioned earlier, the USPF via the secretary of the agency responded to the questionnaires sent to them. From the findings made in the questionnaire, the funding of Universal Service in Nigeria has been the prerogative of the Universality Fund established by the Nigerian Communications Act of 2003 Act number 19. The role of the USDF has been to design, develop and implement programs and projects that will facilitate widespread availability and usage of network services and application services throughout Nigeria. They carry out their role by encouraging the installation of network facilities and the provision of network services and application services to institutions and in un-serves, underserved areas of for underserved groups (Source Questionnaire response from USPF). This agency funds universal access and service in Nigeria and in this chapter, they are the main subject of analysis.

However, in this chapter, the emphasis is on the fund itself as this research is built around the fund and communities towards developing Broadband in rural areas.

10.3.2 APPLICATION OF STAKEHOLDER THEORY

In this section, the identified key stakeholders managed by USPF are enumerated. The relationships between the stakeholder and the universality fund Manager based on the stakeholder function is also enumerated. The implications of the relationships with the USDF based on the Nigerian Communications Act of 2003 and the Universal Access and Universal Service regulation of 2007 are analyzed using the Stakeholder Salience Theory. This set of relationships aids in identifying which of the stakeholders are necessary for the community based networks. Some existing PPIs will be identified to understand if there is potential for adopting PPIs by the USPF. The Universal Access and Universal Service regulation 2007, provides a clear institutional framework for the operations of USPF. Here the answers from the questionnaire will be narrated. Finally the implications of the findings will be discussed to find out if the USPF has the experience of working with the social structure in rural areas and if there are possible constraints.

Stakeholder Identification: The stakeholders identified were done mainly via purposive sampling; this was because of the familiarity about the Nigerian Universal Service environment. Snowballing was also adopted as a result of leads from the documentation. The USPF projects mentioned in the questionnaire and their website were identified and the stakeholders involved in the project were identified. In circumstances where the function of the stakeholder was unknown, a search was made online, which led to other stakeholders that have an influence on the project, being identified. An example is the fact that it was unknown earlier at the start of this research that the USPF was an agency of the regulator an also receives funding from the National assembly (National Legislature).

USPF just like GIFEC is mandated to partner with any stakeholder to facilitate its mandate. The agency's mandate is not just toward rural areas as Universal Access and Universal Service as defined in the Universal Access and Universal Service regulation of 2007 implies 100% Access to ICT infrastructure by population and 100% private subscription and usage of ICT service by population. The current projects as well as stakeholder specification from the aforementioned legislation served as key to identifying the various key stakeholders, despite the data sampling process.

The key stakeholders identified via purposive sampling was the Federal Ministry of Communication Technology, The Universal Service fund (USPF), Telecom Network operators, Internet Service Providers, ICT/ Telecom contractors, communities (rural areas), educational institutions. Stakeholders identified via snowballing were, the National Assembly, The National Communications Commission (NCC), the Nigerian University Commission (Agency), Ministry of Education (Ministry), National Planning Commission (agency), Ministry of Finance, World Bank (International Donor agency), USPF Fund Managers (investment management firm, NGOs, local entrepreneurs and media.

Just as in the case of GIFEC, these stakeholders could be classed as Public, Private and civil society stakeholders. These stakeholders aside single agency groups are also black boxes or they represent black boxes. The public stakeholders are the federal Ministry of Communication Technology; the federal ministry of finance, the regulator (NCC), Universal Access fund (USPF), Ministries, Government Agencies (Nigerian University Commission, National Planning commission etc.), the national assembly and public educational institutions. The private stakeholders include the telecom network operators, ICT/Telecom Contractors and Private educations Institutions. The civil society includes NGOs, the community, Media and the International Donor agencies. It should be noted that the splitting of educational institutions into being either public or private is just for the purpose of indicating that they are both public and private stakeholders. However, they will be treated as a whole henceforth.

Also, as in the case of GIFEC, these stakeholders can be classified as demand stakeholders and supply stakeholders. In this case, some of the stakeholders, just as in the case of GIFEC, will belong to the two or none of the groups. On the Supply side, you have the universality fund, the regulator, The national assembly ISPs, ICT/Telecom contractors, international Donor agencies, Ministry, Government agency, local entrepreneurs and the Network operators have been identified as key stakeholders on the supply side. On the demand side there are: the educational institutions, the ISPs, Civil societies, community and NGOs. Just as in the case of Ghana International Donor agencies and NGOs are intermediaries.

The relationship map for this market is difficult to draw because the only NCC and USPF are core demand stakeholders. Others could fall into the demand section at any period. This is because unlike GIFEC, USPF's infrastructure financing so far is not just at the last mile or Access network, but also on the backhaul (connectivity) providing high capacity bandwidth via fiber optics. Hence, any of these stakeholders could become users of USDF funded infrastructure provided via supply push. The core similarity between GIFECs effort and the USDFs effort is that most of the initiatives are supply push initiatives. Still on the demand side, USDF in also facilitates demand via capacity building. But if one were to assume that the black boxes on the demand side and the supply side were domicile to distinct stakeholders, then figure 8.1 holds here. The only difference would be that demand is not weak. There is a higher demand for the internet in Nigeria than in Ghana. Data from Internet Society indicates that Internet penetration in Nigeria and Ghana are 38% and 12.3% respectively (Internet Society, 2015). The greater reason for this is because Nigeria is a federated state with distinct autonomous governments and economy. People tend to care more about what happens in their state, their music local stars, football team etc. Secondly, there is a silent competition among citizens of each state on “Who is savvier?” leading Government of each state to compete in developing essential facilities. The galvanizing point for this ‘beauty contest’ is the internet. However, due to High illiteracy rate compared to the population of 180 million citizens the level of internet penetration is 28%.

STAKEHOLDER RELATIONSHIPS AND FUNCTIONS

Table 10- 10 Stakeholder Relationships and Functions

	Stakeholder	Functions
1	Federal Ministry of Communication Technology	This is the sector ministry in charge of telecommunications and ICT. However, the minister of this ministry is the chairman of the USPF board. The minister also recommends who sits on the board besides representatives of the statutory member bodies.
2	National Communications Commission	This is the regulator and parent agency of USPF. The chairman of the commission is the vice chairman of the board. 2 commissioners from the commission are also appointed to serve on the USPF board. One would say that the NCC shapes the agenda of the board as they also are the regulators of Universal Access and Universal Service empowered by the Universal Access and Universal Service

		Act of 2007.
3	The Universal Service fund (USPF)	The managing stakeholder of the Universality funding ecosystem in Nigeria
4	Telecom Network operators	They receive subsidies from the USPF to provide Base Transceiver stations (BTS) or base stations in rural areas via the Accelerated Mobile Expansion Program (AMEP). They also receive subsidy to facilitate the development of Fiber optics to rural areas under the Backbone Transmission Infrastructure Project (BTRAIN). They receive the subsidies via competitive bidding. They also receive a one –off grant also provided via a competitive process to develop mobile wireless mobile Broadband hotspots in rural areas under the Rural Broadband Initiative (RBI).
5	Internet Service Providers	They are targets for providing internet service on the developed Broadband infrastructure. They are eligible to supply for the BTRAIN project if they have the license to deploy to Optical fiber connectivity and can connect to Optical fiber connectivity. However, they have to bid for it
6	ICT/ Telecom contractors	This could be CPE suppliers or bandwidth providers. They are involved in bidding for the schools/tertiary Institution Knowledge centers such as the School Access Project (SAP), Tertiary Institution Access Project (TiAP), the Advanced Digital Awareness Program for Tertiary Institutions (ADAPTI) - dedicated for tertiary institutions- and the Digital Access Program (DAP) , dedicated to secondary schools.
7	Communities (rural areas)	The main recipient of USPF Infrastructure provision initiatives. They are the recipients of the E-accessibility project, Information Resource Centre (IRC) and Community Resource Centers (CRC) and the upcoming e-health project. The E-Assessibility projects if for the disabled. They are provided with ICT tools and assistive technologies to enable the disable live a comfortable life independently. The IRC is a knowledge management initiative enabled by facilitating digital libraries to existing public libraries. The CRCs are telecentres and also as ICT shops in rural areas.
8	Educational institutions	They are recipient of USPFs Broadband bandwidth, CPE and alternative energy source (Solar panel). Some initiatives include the Schools /Tertiary Institution Knowledge centers, SAP, TiAP, ADAPTI and DAP. They are obligated to provide access of these facilities to the local community. They are also a recipient of the

		University Inter-Campus Connectivity (UICC) which delivers high speed Broadband via Fiberoptics, connecting tertiary institutions in the country.
9	National Assembly	They Fund the USPF. The upper house confirms the appointment of the USPF committee nominated by the president based on the statutory provisions of the National Communications Act of 2003.
10	Government Agencies	The Nigerian University Commission is the agency that regulates universities in Nigeria; they are partners with USPF on the UICC project. The National Planning Commission is a public agency that advises Government on matters relating to national development and the management of the national economy. They are represented on the USPF board.
11	Government Ministries	The ministry of education is a partner with USPF on the UICC project. The ministry of finance is represented on the USPF board.
12	International Donor Agencies	The World Bank is a partner with USPF on the UICC project. USAID provided consultancy for the next phase of the Strategic Management Plan for better results.
13	NGOs	They facilitate the establishment of the USPF Community resource centers.
14	Local Entrepreneur	They facilitate the establishment of the USPF Community resource centers.
15	Media	They publicize USPFs activities
16	USPF Fund Manager	They are an external fund management firm mandated by law to act as external consultant for the purpose of providing professional advice on the management of the fund.

Source (Williams (2015))

10.3.3 STAKEHOLDER SALIENCE IN USPF'S RELATIONSHIP WITH STAKEHOLDERS

In this section the stakeholder salience is being tested. The same criterion used in the case of GIFEC is adopted here.

Power Stakeholders: The stakeholder with greater power here to influence the USPF is slightly different from that of GIFEC. They are the federal Ministry of Communication Technology; the Federal ministry of finance, the regulator (NCC), The USPF fund manager, the National Assembly and communities.

The power of the community is dormant as demand is not that strong on USPF from the communities. The power of the Federal Ministry of Communications is based on the fact that it controls the USPF board in conjunction with the NCC (The regulator). The USPF board provides the agenda of the USPF. The power of the Federal ministry of finance is based on the fact that money received from the National Assembly for the fund is allocated to them by the Federal Ministry of Finance. If they do not allocate funds from source, there will be no funds. The power of the National Assembly is dormant with respect to the day to day running of the USPF. Their powers exist as their joint committee on communication has an oversight function on GIFEC indirectly. In Nigeria, the head of ministries and agencies go to the national assembly annually to defend their budget or the fiscal year. The second power of the National Assembly is based on the ability of the upper house to refuse to ratify or confirm the nomination of the president's choice to the USPF board. Outside that, they do not interfere with the USDF's day to day management of the fund. The NCC, one would say is the most powerful stakeholder here. Although the USPF has some autonomy, it is the implementing arm of the NCC and NCC regulates the agenda of the USPF. The USPF Fund manager is the consulting intermediary between the USPF board and the USPF. Its power lies on the fact that its advice is preferred above others.

The NGO and International Donor Agencies are not powerful as they do not have the mandate to influence USPF.

Urgent Stakeholders: The stakeholders that require urgent attention from the USPF are the community, the NCC, the Federal Ministry of Communication Technology, The Federal Ministry of Finance, the USPF Fund managers, the National Assembly, Telecom Network Operators and Internet Service Providers. The USPF cannot deny the rural communities' attention if they demand for it in line with the USPFs mandate as it is the mandate of USPF to service them. The USPF would not exist in its current state without the sector ministry and the regulator; hence these stakeholders hold high value. The financing of the USPF would not be substantial without the cooperation between the USPF and the National Assembly as well as the ministry of finance. The value of the USPF fund managers is also high as their report is crucial for the agenda framing of the USPF board. The urgency level for the ISPs, and Telecom network operator on the other hand is low. 40% of USPF contributions come from levies leveled on the telecom network operators (Southwood, 2002). This implies that 60% of USPF emanates from other sources such as Government budgets, stock and short term investment, and contribution from the regulator. However, their urgency is only high is projected that involves them (telcos) deploying infrastructure. If a project does not involve the telco, there is no need for the USPF to manage its relationship with the telcos. In the case of the ISPs, their urgency is high when they have won a bid and are on the project. But when they are not engaged in any project, the urgency to manage their relationship is low. The educational institutions, NGOs and Government Agencies also require urgency if their demand is in line with the USPF mandate. In this sense, as mentioned earlier, USPF sees the educational institutions as a point of access to the communities, who is their primary beneficiary. The NGOs and International Donor Agencies require urgency when their demand or supply facilitation is also aimed at extending Broadband to rural areas. The Government agencies do not require urgency as they mostly are partners to a larger consortium such as in the TiAP project. He same is applicable to the federal ministries besides the principal ministries (sector and finance ministries).

Legitimate Stakeholders: Based on the aforementioned laws, the communities are legitimate as they are the target recipient of the telecom service. However, based on the fact that the USPF is permitted to partner anyone towards the development of ICT in rural areas, all the stakeholders are legitimate. The USPF in its demand facilitation and supply push efforts has not deviated from its mandate; hence from this standpoint the stakeholders identified from the projects cited so far are legitimate. However, it is important to note that stakeholders such as educational institutions would have been illegitimate if the effort channeled in that area was not geared towards its mandate.

Having identified the attributes of the stakeholders, it is important to see the level of salience for each stakeholder.

Table 10- 11 Stakeholder Classification (Nigeria)

Stakeholder	Power	Urgency	Legitimacy	Stakeholder	Stakeholder class
Communities	-	-	-		
Federal ministry of Communications	-	-	-	Definitive	Definitive

Technology				Stakeholders	Stakeholders
NCC (The regulator)	-	-	-		
the Federal ministry of finance	-	-	-		
the National Assembly	-	-	-		
The USPF Fund manage	-	-	-		
Telecom Network Operators		-	-	Dependent Stakeholders	Expectant Stakeholders
Internet Service Providers		-	-		
International Donor Agencies		-	-		
NGOs		-	-		
Educational institutions		-	-		
ICT/ Telecom contractors			-	Discretionary	Latent Stakeholders
Government Agencies			-	Discretionary	
Federal Ministries			-	Discretionary	

Local entrepreneurs	-	Discretionary
Media	-	Discretionary

Source (Williams (2015))

The extrapolation made so far also indicates that the 3 classes of salient stakeholders can be identified in the Nigerian Universality funding echo system at present. These include the Latent stakeholder, the Expectant Stakeholder and the Definitive stakeholders.

Definitive stakeholders: The Nigerian Governance system is highly bureaucratic, and this is represented in the constitution of the USDF board, which is controlled by the Public sector. In this manner, the USDF has the discretion of choosing who will or will not be its stakeholder, who deserves urgency and who is legitimate. It is impossible to foresee the USDF board and administrator, granting powers to the other stakeholders as the necessary acts do not, hence with the NCC's backing the board has the power to coerce.

Expectant Stakeholders: Here the stakeholders are all dependent stakeholders. None of the stakeholders identified in this case are either dangerous or dominant. Although they possess legitimacy, they lack power. Unlike the Ghanaian case, the Network operators and the ISPs do not possess the power to influence the USPF; rather they are partners necessary for the infrastructure development projects of USPF. In this case they are dependent stakeholders as they are legitimized by legislation. As partners in the development of Broadband infrastructure, they are urgent stakeholders. This does not imply that the private sector influence does not exist on the board. It does, but on a there is no representation from the telecom companies, but the private sector in general. These private sector representatives are appointees of the president. Hence the salience of the ISPs and Network operators can only increase if it is granted by law as in the case of Ghana.

Latent Stakeholders: The supply of ICTs and telecom infrastructure in rural areas is a supply push. But the supply push is based on legitimacy of the claim in line with the legislations. Hence the latent stakeholders here are mostly discretionary; the USPF can actually do without them.

10.3.4 CURRENT ORGANIZATION AND FINANCING ARRANGEMENT OF USPF NIGERIA

The USDF unlike GIFEC is not very autonomous. It manages its stakeholders based on legislation; hence stakeholder legitimacy is very important. However the USDF is very ambitious providing both backhaul and Access connectivity to rural areas. This is a great positive. It is also one of the very few of such initiatives in Africa. This is where the strength of the USPF Definitive stakeholders and Expectant (network operators) lies.

The USPF are not financially dependent on network operators. Hence, they are not affected by the influence of network operators, who have not been granted power by legislation. The network operators already have their individual activities, hence USPFs incentives aid in furthering their activities. They cannot force the USPF for it. The USPF also enjoys more than 60% of its funding from the national budget and their investments, while 40% of their investment is from the network operators annual contributions (Southwood, 2002). Hence the network operators cannot become dangerous stakeholders. Based on this strength the USPF can embark on laudable projects in Nigeria

In organizing its ecosystem, the USPF has adopted PPPs in the development of the backhaul connectivity and service contracting in the development of Broadband access connectivity. Hence the adoption level of PPIs for the USPF is high. They prefer to finance projects than to be involved or own an infrastructure. However, as USPF is guided by law, it does not necessarily grant devoted attention to latent stakeholders. Its focus is more on the definitive and expectant stakeholders. The latent stakeholders are only needed if necessary. USPF is looking forward to more grassroots project initiatives that can be facilitated from multiple stakeholders.

However, the USPF is very unique in how it relates to its stakeholders and the type of projects it embarks on. Although the USPF works within its mandate, it is free to partner with any stakeholder that will help them fulfil their mandate. This implies flexibility. Based on the analysis of the findings and the responses from the USPF, one would say that the primary cases can become an inspiration for the bottom-up initiatives the USPF yearns for.

10.3.5 IDENTIFIED PPI

The identified PPIs are service contracting and Private DBOs.

Service Contracting: This involves the USPF contracting either the supply of CPEs or bandwidth to community centers or educational institutions. Examples of projects facilitated via service contract includes: The School Access Project (SAP), Tertiary Institution Access Project (TiAP), the Advanced Digital Awareness

Program for Tertiary Institutions (ADAPTI) and the Digital Access Program (DAP).

Private DBOs: The USPF just like many other Universal Access Funds globally subsidizes the funding of Broadband and telecommunication infrastructure development. One cannot deny that the subsidization of private infrastructure delivery is a form of PPI. However, in recent times as mentioned in chapter 3, this is also a form of Build Develop Own form of PPP. However, it is the private sector that owns the infrastructure. Hence the USPF practices the private DBO form of PPP in the delivery of some of their projects. Examples of such projects include the Accelerated Mobile Expansion Program (AMEP) and the Backbone Transmission Infrastructure Project (BTRAIN). This differs from the Ghanaian Public DBO approach.

Another project that is a Private DBO is the University Inter-Campus Connectivity (UICC). This project is also funded by USPF and it involves the NUC, The Federal Ministry of Education and the World Bank. The Private DBOs are deployed mostly in the provision an extension of backhaul infrastructure.

CHAPTER 11. SUMMARY OF THE FINDINGS AND DEVELOPMENT OF THE PPI MODELS

11.0. INTRODUCTION

In this chapter an attempt is made to make sense of the relationship between the findings, the analysis and how it addresses the objectives of this research. It is a synopsis of the work done in this report. Here, in this section, the implications of the findings for the research objectives are discussed.

11.1 OBJECTIVE 1

The first object was to identify what form of PPI initiatives exists in Ghana and Nigeria.

11.1.1 SUMMARY OF FINDINGS INSPIRED FROM LITERATURE REVIEW

In the literature review section, PPI was categorized into different historical time frames. In the identified time frames PPIs in the development of telecom infrastructure in some countries can be identified. These time lines were: the monopoly era, the market reform era and the post market reform era. However, Broadband infrastructure development in Nigeria and Ghana were a product of the post-market reform era as seen in the table below. The table below presents the identified forms of PPI in Ghana and Nigeria in the different historical time frame.

Table 11- 1 Summary of Findings inspired from Literature

	Historical Time Frame	**Ghana**	**Nigeria**
1.	Monopoly Era	Service contract relationships	Service contract relationships
2.	Market reform era	privatization and the telecom market liberalization	privatization and the telecom market liberalization
3.	Currently	direct public investment in the development of Broadband infrastructure as well as Public Private Partnerships	direct public investment in the development of Broadband infrastructure as well as Public Private Partnerships

Source extracted from (Williams & Kwofie, 2014)

In general, both countries share similarities in their approach towards the development of telecom infrastructure. However, in the development of Broadband infrastructure, there are also similarities in the private expansion of wireless Broadband infrastructure and very little fixed Broadband infrastructure. The over-arching approach here that led to private investment was a PPI as seen in the table below.

Table 11- 2 Public and Private responsinility in Broadband Infrastructure development in Ghana and Nigeria

	Public responsibility	**Private responsibility**
1.	Gateway liberalization	Private investment
2.	Backhaul liberalization	Private investment

Source extracted from (Williams & Kwofie, 2014)

The foundation for Fixed-Broadband exists in both countries with the facilitation of a fixed Broadband gateway (Fibre optics) which is a result of the gateway liberalization policies adopted by both countries. One would identify these acts as the interplay between public responsibility (Governance via policy and regulation) in conjunction with private investment facilitation. However, the access networks are mostly mobile networks. The national backhaul in greater parts of both countries is facilitated with fiber optics by the private sector.

Aside the similarities, in the development of the national backhaul, the PPI approach has been different in both countries. The results obtained in chapter 10 indicate that both countries differ in the actual PPI facilitation process. They differ in:

- The public and private resources provided towards the facilitation of the infrastructure by both the public and private sector.

- They also differ in the way the universality funds in both countries prioritize what Broadband infrastructure should be facilitated and how it should be facilitated. In Nigeria, the focus is on the development on fiber optic backhaul using universality funds. In Ghana the focus in on wireless last mile facilitation using universality funds.

SPECIFIC FINDINGS ON PPP IN NIGERIA

In Nigeria Broadband backhaul infrastructure development has been the prerogative of the private sector. The public sector, as mentioned in chapter 10, provided financial incentives for the expansion of private Broadband backhauls via universal service funding and direct Government financing as seen in the table below. The facilitation as mentioned in chapter 10 was for both fixed and mobile Broadband operators, as well as private infrastructure providers.

Table 11- 3 Public and Private Responsibilities in the Provision of Broadband Infrastructure in Nigeria

	Public sector	**Private sector**
1.	Central Government financing	Private investment
2.	Universal service funding	Private ownership of infrastructure
3.	Provision of subsidies via universal service funding	Infrastructure construction
4.	Governance (policy and regulation)	Infrastructure operations
5.	User capacity building	Customer acquisition
6.	Project design	

The results as mentioned in chapter 10 and in the table above points to the fact that the Nigerian universality fund are more comfortable with Public Private Partnerships. The Design Build Operate (DBO) form of PPP is evident in the infrastructure cases –in Nigeria- cited in this report. The Nigerian Government in facilitating CDMA wireless Broadband backhaul for the National Rural Telephony Project adopted the Public DBO. The form of PPP adopted by the Nigerian Universality fund towards Broadband development is Private-DBO. This PPP approach as seen in chapter 8 is adopted because the Nigerian Universality fund (USPF) have a huge budget for funding Broadband infrastructure development as they have multiple source of funding. Secondly, they have an array of Network Operators, Broadband, Infrastructure Providers and Internet Service Operators to work with. Thirdly, although the universality fund is an agency of the regulatory body, they are independent in how it is organized and financed.

PPPs are expensive ventures; hence before PPPs are embarked upon, it has to be assessed. One of the factors assessed are the risk allocation, affordability of the PPP, bankability of the PPP (The willingness of lenders to finance the project) and Value for money (European investment Bank, 2015). Bankability of the PPP and the Value for money aspect of the PPP cannot be discussed here as information for discussion on these matters in this case is limited. The original idea behind value for money was; the project costed less than an alternative public sector alternative project that would deliver the same service (Williams, Adjin, & Tsivor, 2014) (European investment Bank, 2015). In recent times, value for money also denotes the "net positive gain to society which is greater than that which could be achieved through an alternative means" (European investment Bank, 2015). However, the possibility of the PPPs in the development in the Broadband from the data gathered can be discussed from the affordability and the risk factor point of view.

Broadband PPP Affordability in Nigeria: This is the ability to pay for the infrastructure as well as the level of public expenditure needed for the project over time (European investment Bank, 2015). In the Nigerian case as mentioned in chapter 8, the public sector initiates and designs the project, but the winner of the procurement owns operates and manage the infrastructure with public subsidy. Infrastructure affordability with this form of PPP approach as seen in chapter 8 is adopted because the Nigerian Universality fund (USPF) has a huge budget for funding Broadband infrastructure development as they have multiple source of funding. Secondly, they have an array of Network Operators, Broadband Infrastructure Providers and Internet Service Operators who can bankroll huge infrastructures, to work with. These private sector companies are both national and multi-national companies. The revenue requirement for the Nigerian case is the "user-pay" and not the "authority pay". Hence, there is the commercial risk on the demand side. The user pay model is adopted because it is assumed that the private entity already has a plan to facilitate demand. The authority pay model is not adopted because the USPF intend to fund multiple projects; hence paying a service fee to the private sector over time would not facilitate multiple infrastructure delivery.

PPP Risk Factors in Nigeria: Based on these existing PPP affordability factors, and as seen in the table above the commercial risks of the PPP are shared. The supply risk- the capability of the private sector to deliver – is shared both by the public and private sector with regards financing the projects. However the infrastructure construction and operational risk are borne in a greater part by the private sector. The government subsidy plays a minor role in the construction and operational process. Still on the demand side, the risk is borne more by the private sector as they have to advertise their services and scout for customers. The public sector with via the USPF as seen mentioned in chapter 10. Share in the risk via capacity building in the rural areas. However, one would say that the public effort in capacity building is not necessarily part of the PPP but an indirect aid worth mentioning. This is because the capacity building aids demand.

The regulatory risk or legal risk in Nigeria with regards telecom infrastructure development was low. This is because the legal and regulatory framework with which the USPF operates in relation to the private sector exists in the Nigerian Communications act of 2003. This is not a specific act for PPPs but over-arching regulations that stipulates the relationship between the USPF and the private sector. However, in the PPPs between central government and the private sector, there are legal frameworks. The Nigerian Communications Act of 2003 serves as the regulatory framework. The private sectors' faith in the Nigerian justice system as a means of dispute regulation is an important factor that has enabled PPP in the Nigerian case.

Political risk in Nigeria, with regards nationalization and expropriation is low. This is because Nigeria is a capitalistic country and from the last part of the century till date; the Nigerian government has privatized a lot of public utility agencies.

The technological risk is affected by the scope of the technology, the feasibility of the technology, ownership of the technology and governance of the technology. Here the technology risk involving technology feasibility, ownership and scope of deployment is borne by the private sector. The governance as mentioned earlier is provided by the private sector. The facilitation of rural fibre optic backbone implies that the public sector believes in the ability of the private sector to deliver on the expensive Broadband backbone infrastructure.

These are few risk factors that are plausible reasons why the PPP could have occurred. However, one would say that the Nigerians had the resources to facilitate Broadband backbone and access wireless networks –even towards rural areas- with PPPs because they could afford it and could bear the risks.

SPECIFIC FINDINGS ON PPP IN GHANA

Ghana on the other hand utilized more of PPI in facilitating both the backhaul network. Initially the Broadband backhaul provision was facilitated by the Public sector. In Ghana, as mentioned in chapter 10, The Government of Ghana facilitated the development of a Fiber-optic backhaul for the country. This was a service contract between the Government of Ghana and Huawei (Williams, Adjin, & Tsivor, 2014). This was because the existing Voltacom Fiber optic infrastructure was the only Broadband backhaul available. Hence the government of Ghana decided in 2007 to expand the infrastructure to other parts of the country. Unlike the Nigerian, case, there were few telecom infrastructure providers. This was a PPI (Service contracting). This could not be called a PPP because the public sector contributed nothing directly to the project. The liberalization of Broadband backhaul provision, led to competitive Broadband backhauls being developed by the Mobile Network operators such as MTN, GLO and Tigo. Here one would say that the government resource here towards infrastructure development was via governance.

However, the Ghanaians on the other hand embraced another form of PPP in facilitating wireless Broadband infrastructure. As mentioned in chapter 10, the government of Ghana via the universality funds (GIFEC) has also adopted PPPs. These PPPs were Public DBOs aimed at facilitating mobile Broadband backhaul and last mile extension.

In the Ghanaian case as seen in the table below, the affordability and the risk burden lay on the public sector led by the universality fund GIFEC.

Table 11- 4 Public Responsibilities in the Provision of Broadband Infrastructure in Ghana

	Public sector	**Private sector**
1.	Infrastructure ownership	Infrastructure leasing
2.	GIFEC financing	Customer acquisition
3.	Infrastructure construction	Infrastructure operation
4.	User capacity building	
5.	Project design	
6.	Regulatory framework	

Williams (2015)

Broadband PPP Affordability in Ghana: As seen in chapter 10, the fact that GIFEC has been able to facilitate numerous forms of wireless Broadband last mile infrastructure in this manner implies that they have the capacity to pay, operate and maintain the infrastructure. If this were not so then they would have adopted the Private DBO form of PPP. Quite unlike the Nigerian case, the Ghanaians are funded primarily by the 1% contribution from the telcos. Hence the number of projects and the magnitude of projects they embark upon is of a smaller proportion to that of the Nigerian Universality fund. The infrastructure revenue the authority pay a form of PPP. However, the authority that pays here is the private sector that leases the infrastructure. The involvement of the central government in Broadband PPP facilitation was not identified. Secondly, PPP investment in the fixed-Broadband networks was also not identified.

PPP Risk Factors in Ghana: The commercial risk is shared in a lopsided fashion. Here the Public sector bears more risk than the private sector. On the supply side of the market, GIFEC bears the supply risk. They bear the risk with regards construction and the private sector bears the risk with regards operations of the infrastructure. The only disadvantage with this form of risk is, that the private sector may in principle agree with this form of PPP but end up not using the infrastructure. Although this is not necessarily the case in Ghana, the reality is that the telecom network operators have sold their towers to tower providers- such as Helios ATC, Eaton etc., who in turn outsource the towers to the telecom companies. This is a trend that is prevalent in Africa. Hence, GIFEC had to overcome this risk by providing their infrastructure in areas where these towers do not exist. On the demand side of the market, the private sector bears the risk. GIFEC also aids in reducing the risk borne by the private sector by embarking on capacity training of users.

The legal risk in Ghana is high as mentioned earlier. This is because the regulatory and legal framework that facilitates this PPP was not designed for PPPs. This if the Ghana National Communications Authority Act of 2008. Hence, if the private sector decides not to use the infrastructure designed by GIFEC, GIFEC cannot sue them. GIFEC's managerial board is the management for of PPP; however agreements made here are not binding. Hence such a dispute cannot be resolved in court.

However, the political risk here is very low. There is no threat of expropriation or nationalization because the public already owns the infrastructure. The technology risk here is borne by the public sector. As the infrastructure is owned by GIFEC, hence they bear the ownership risk. If the infrastructure is utilized by the private sector, then the Public sector gains. However, if the infrastructure is not utilized, they may run at a loss. The technology coverage scope and feasibility of the technology are determined by the public sector and the nature of the rural area in terms of the population, cost of deployment of infrastructure, operational and maintenance cost, lack of existing telecommunication networks and the socioeconomic dynamics of the area. These were some of the factors that led to the facilitation of wireless Broadband Infrastructure-as it is cheaper to facilitate than fixed Broadband infrastructure.

11.1.2 IMPLICATION OF FINDINGS TO THE OBJECTIVE

The implication of the summarized findings point to the fact that:

- Both countries are not strangers to PPP and PPIs.

- It also points to the fact that they are willing to embark on more collaborative initiatives between the public sector and private sector to facilitate Broadband development. This is buttressed by the responses received universality funds from both countries. The questionnaire questionnaire response from the Nigerian USPF was emphatic about the fact that they are open to PPPs and looking more for bottom up approaches. A telephone interview with GIFEC pointed to the fact that they are also open to collaborating with the private sector in more innovative ways than they are doing presently.

- Broadband infrastructure development in both cases can be facilitated via PPPs because the affordability and risk factors can be surmounted. The caveat here is both countries have adopted the phase-by-phase approach to Broadband infrastructure development. Hence, over time, they will be able to facilitate Universal access of Broadband infrastructure development.

The current existence of PPPs in the development of Broadband infrastructure implies that “bankability” of a larger proportion of Broadband infrastructure development can be achieved from a top-down approach. At the moment, the public sector in both countries are yet to fund bottom-up approaches

11.2 OBJECTIVE 2

The second objective was to understand the usage impact of the identified PPIs to the development of Broadband Internet in Ghana and Nigeria.

11.2.1 SUMMARY OF FINDINGS MADE FROM OBSERVATION OF THE PROBLEM

In the 7th chapter of this report, the results of the exploration indicated that Mobile and fixed Broadband subscription was very low in sub-Saharan Africa. The story was not different from that of Ghana and Nigeria. However, the results also gathered on the spread of the mobile Broadband infrastructure corroborated with this fact.

11.2.2 IMPLICATION OF FINDINGS TO THE OBJECTIVE

- The implication of this finding is that despite the various forms of investments aimed at developing Broadband infrastructure, there is a huge Broadband infrastructure deficit gap at the access network level. A lot of investment has gone into the backhaul development. In urban centers, of Sub-Saharan Africa and specifically, Ghana and Nigeria, Universal Service of either Mobile or fixed Broadband services is still very low.

- This also raises the issue of usage, especially in areas where market facilitation or public intervention has led to the facilitation of the backhaul infrastructure but few users exist in such rural areas. This is not necessarily as a result of low population density, which is not often the case, but the lack of knowledge of what to do with the service.

- The final implication is that more needs to be done in facilitating Broadband Access networks in the cases studied. Hence, the adoption of new approaches such as the ones studied in this report becomes necessary.

11.3 OBJECTIVE 3

The third objective was to identify innovative PPI Initiatives elsewhere that can fill the Broadband internet gap in Ghana and Nigeria. The reason for this objective was to identify initiatives that can complement existing initiatives in Ghana and Nigeria. The criteria for the search were:

- The initiative should be facilitated in rural areas.

- The initiative should be different from popular initiatives in Nigeria and Ghana.

- The form of collaboration, cooperation and partnership between the public and the private sector could be strong, weak or loosed.

11.3.1 SUMMARY OF PPIS IDENTIFIED IN EACH PRIMARY CASE FROM ANT ANALYSIS

In the report, bottom-up initiatives were identified from Denmark, Sweden, India, South Africa, Ghana and The United states of America. These were the

Djurslandsnet (Denmark), Magnolia Road Internet Coop (USA), Hallaryd Coop (Sweden), Dharamsala Wireless network owned by Airjaldi (India), Johannesburg Wireless User Group (South Africa) and the Wireless Ghana project (Ghana).

In Sweden, the fixed Broadband development initiative was a blended approach or the hybrid approach. The municipality adopted the top-down approach but facilitated the bottom approach for Broadband coops that were not in existence. Hence, the Almhult Municipality Broadband (Sweden) is not described at the bottom up-approach but the hybrid approach. However, in the table below the Coop initiative and the Municipality initiative are identified in its hybrid form. This was done to avoid repetition on the responsibilities of the public and private sectors.

However, the Almhult Municipality Broadband serves as inspiration on how municipalities can be involved in facilitating bottom up processes. The table below provides a summary of the cases that were PPIs, those that were not PPPs and potential PPPs.

Table 11- 5 Primary Cases and the Types of PPIs Identified

	Case	**Public responsibility**	**Private responsibility**	**Type of PPI**
1	Denmark (Djurslandsnet)	Financing via EU funding Deregulation of Wi-Fi spectrum	Coop financing Infrastructure design Infrastructure building Infrastructure implementation Infrastructure maintenance Infrastructure operation	*Public subsidy
2	Sweden (Almhult municipality/ Zitius/ Hallaryd	Municipality funding	Private sector infrastructure outsourcing Private sector infrastructure maintenance	It is a PPP The Backhaul network facilitation was

	Coop)	EU funding Regulation for public funding Infrastructure design Backhaul building Backhaul implementation	Private sector infrastructure operation Coop financing Coop Access network design Coop access network building Coop access network implementation Coop Access network operation Coop access network maintenance	a Public DBO The Access network facilitation was a Private DBO
3	India (Airjaldi)	Market reforms aimed at lowering market entry barriers Deregulation of Wi-Fi spectrum	Private infrastructure financing Private infrastructure design Private infrastructure building Private infrastructure implementation	Not a PPP but a private initiative. But it is a PPI because this project would not have been possible without the public responsibility

			Private infrastructure operation	
4	USA (Magnolia Road Internet Coop)	**Public financing if the project is worth a minimum of $100 000 Deregulation of Wi-Fi spectrum	Coop Financing Coop network design Coop network building Coop network implementation Coop network operation Coop network maintenance	Not a PPP due to reasons mentioned below (**). However, it was a PPI because, without the deregulation of Wi-Fi spectrum, they would have had to look for another solution
5	***South Africa (Johannesburg Wireless User Group)	Deregulation of Wi-Fi spectrum	Coop Financing Coop network design Coop network building Coop network implementation Coop network operation Coop network maintenance	It is a PPI because this project would not have been possible without the public responsibility
6	Ghana Wireless Ghana Project	Deregulation of Wi-Fi spectrum	NGO Financing NGO network design Coop network building Coop network implementation	It is a PPI because this project would not have been possible without the public responsibility

	Coop network operation
	Coop network maintenance

Williams (2015)

*This case would have been a Public DBO if the EU was directly involved in the project.

**They could not get this financing as their total expenditure was between $13 000 and $15 000. It would have been a PPP (private DBO) if they were qualified for the involvement of the State of Colorado.

***The only non-rural case

The Swedish case was a fixed-Broadband infrastructure development project. Aside the Swedish case, the other cases were facilitated by the civil societies and an NGO (Non-Profit private sector).

In the cases identified, they were mostly PPIs. One of them was more coordinated PPIs in the form of PPPs as seen in the table above. In the case of DjurslandsNet, the case would have been a PPP if they had succeeded in getting some direct government involvement for the project. The EU financing did not make the EU committed to the project in the same manner the Almhult municipality case occurred.

However, in all the cases as seen in the table above, it was clear that public regulation via the deregulation of Wi-Fi (802.11 Spectrum) was a major driver towards the desire to develop the wireless networks. However, in the private sector domain, there was a strong influence from civil society (Coops and NGOs). These groups often comprised of non-technical people–aside the case of India and Ghana. They were self determined people who facilitated the wireless Broadband network design, network financing, network implementation, network operation and network maintenance.

In the USA case, they were not qualified for public funding, in the Danish case, there was EU subsidy and in the Swedish case, there was direct public financing from the municipality. The rest had no other external source of funding. However, in the Ghanaian case they did source for it.

These cases presented bottom up approaches which are not prevalent in sub-Saharan Africa. The Ghanaian case presented an attempt towards a bottom up initiative that faded due to lack of funding. The Swedish case presented a mixture of a top-down and bottom-up approach towards fixed Broadband infrastructure development aimed at facilitating fixed-Broadband infrastructure.

In all the cases except the Swedish case, the private sector bore the commercial risk. This was an interesting aspect of these cases and opened up the opportunity to investigate more into the cases to understand the process using Grounded Theory. However, in the Ghanaian case, the Pandora's Box that opened up from the demand side of the commercial risk was that prior telecentre initiatives led to the existence of latent demand. The implications of these findings to the research are listed in the next section below.

11.3.2 IMPLICATION OF FINDINGS TO THE OBJECTIVE

- Bottom up approaches that could supplement the existing top-down approaches in developing countries, sub-Saharan Africa and the primary cases of Ghana and Nigeria were possible.

- The need for public funding for such approaches in sub-Saharan Africa was identified. The existence of these initiatives led to the understanding that the Public sector and private sector (People and enterprises) could partner to facilitate people led and people owned networks. The role of the people was important here because as will be discussed later, their needs drove the process.

- This implies that the bottom up approach opened a new door towards how PPIs and PPPs can be organized from the bottom-up approach towards Broadband infrastructure development.

- People in rural communities in developed and developing countries have the inner potential to organize themselves and facilitate Broadband development if certain factors come into play. These factors are mentioned later in this report.

- Most importantly, the identified cases pointed to the fact that the universal service of Broadband internet can be achieved faster if bottom-up initiatives are facilitated to support existing top-down initiatives.

11.4 OBJECTIVE 4

The next objective was to find out how the identified external PPIs were organized and how they were managed. The essence of this objective was to identify inspirations on how the identified initiatives could be facilitated in Ghana and Nigeria. However, before thinking about the application of the identified initiative in Nigeria and Ghana, it was important to understand how these cases were organized and managed. This objective was critical as it provided an inspiration for sub-question two of the research question, which was "how are these PPI organized?"

11.4.1 SUMMARY OF ORGANIZATIONAL FINDINGS FROM ANT ANALYSIS

The organization of the cases differed as each case occurred in different contexts. The summary of the organization and management of each coop was extracted from the results of using the Actor Network Theory. The table below presents the cases, their organization and management.

Table 11- 6 Identified Organizations in the Different Primary Cases

		Organization	Management
1	Denmark (Djurslandsnet)	Cooperative organization	A central board managing sub - boards from each parish A central chairman Chairmen, secretaries and their treasurers of sub-boards were members of the central board
2	Sweden (Almhult municipality/Zitius/Hallaryd coop)	Municipality coordinating board Zitius management Coop organization	There was a municipality office in charge of the project Zitius management Coop management board
3	India (Airjaldi)	Private sector management	Non-profit management Commercial management
4	USA (Magnolia Road Internet coop)	Cooperative organization	A coop management board
5	South Africa	Cooperative Organization	A coop management board

	(JAWUG)		
6	Ghana (Wireless Ghana)	Non-Governmental organization	The Information technology department led by John Atkinson managed the project

The organization and management of the cases differed. This was as a result of the social environment they found themselves. It is important to note that the word "rural" does not possess universal attributes. A scenario that is rural to one social context may not be rural to another social context. In this report, rural is used with respect to telecom and ICT infrastructure. Hence, areas that are not commercially viable is regarded as rural. Commercial viability in this report ranges from the absence of commerce, low population density, low economic manpower, and absence of social amenity, remote areas, areas outside a city or an underdeveloped area. The basic thread here is that any area with any or all of these attributes is regarded as rural. In this case, a telecommunications network provider would not find the place viable to attract return on investment.

Djursland was considered rural due to low population density of its towns, and it has a lot of countrysides in the non-cosmopolitan areas. Magnolia Road was considered rural due to low population density and it is located around the Sugarloaf Mountains in Colorado USA. Almhult is considered rural due to low population density and it is remote, just like some areas of Djursland. Dharamsala (Airjaldi) is considered rural due to low population density and medium social amenity. The area is also very mountainous. There is a part of Dharamsala that is a bit cosmopolitan. The people are also low income earners. However, Airjaldi does not invest in cosmopolitan part of Dharamsala due to high competition from mobile network providers. The Akuapem Ridge Area- where the Wireless Ghana is located- is rural because of the low population density, low social amenity, low income earners and it is located outside the city.

However, Scandinavia is a democratic society with the cooperative culture. Hence, in organizing the people, Djurslandsnet and its emergent 10 networks and Almhult municipality opted for cooperatives as a way of organizing themselves. In Djurslandsnet, the 10 new networks were actually sub-confederate coop networks of Djurslandsnet. In Almhult, there are 9 cooperatives working with the municipality and Zitius. As mentioned in chapter 3, Coops were the vehicle of people's action since the great depression in North America, hence the Magnolia Road Internet coop is one of the many Broadband coops in the United states. In this case, the cooperative form of organization. Hence, in the developed country cases studied here, the cooperative form of organization managed by fixed term elected board members were the preferred means of organizing and managing the networks.

These networks were operated by volunteers, who were not remunerated. However, in the case of Djurslandsnet, volunteers who represent an external body on the board were remunerated.

In the developing country cases, the South Africans adopted the Cooperative form of organization. There are lots of Wireless user groups in South Africa organized in this manner. However, in Ghana, the organization and management of the infrastructure was by an NGO. In India, Yahel's personal NGO managed the network before it became commercialized. The NGO approach was adopted because it was the best means to facilitate a supply push. However, the interest of the village council in managing Wireless Ghana proved that, local social structures that is trusted and respected by the people can also be a way of organizing and managing Broadband networks.

The involvement of the private sector was evident in the Swedish and Indian case. In the Swedish case, the municipality found them useful for both the municipality and the coops. However, in the Indian case, they found the network useful, hence they invested in the network. In Ghana, a competitor came into the market to compete with the Wireless Ghana project. This actually led to the demise of the project, but also to the exit of the private sector wireless Broadband competitor.

11.4.2 IMPLICATION OF FINDINGS TO THE OBJECTIVE

- The first and most important implication of this finding was that people in rural areas had the potential to organize themselves based on their social context to facilitate wireless Broadband networks.

- The coops worked with numbers, hence the people had to pay less and the focused more on Wi-Fi networks. In sub-Saharan Africa, people can raise money over time and not one time.

- The private sector as in the Swedish case would be willing to invest in rural areas if there are financial and commercial incentives to do so. The same was the case in the case of MRIC USA. The only problem was that MRIC was not qualified for funding.

- Municipalities or Government agencies, if willing can facilitate Broadband infrastructure development. This can preferable be wireless Broadband in rural areas of Ghana, Nigeria and other sub-Saharan African countries.

In areas, where there are no coops, the rural social system or NGOs can serve as facilitator for such networks

11.5 OBJECTIVE 5

Once it was clear how the PPIs were organized, the next step was to understand how the PPIs wad financed. This aspect was important because the cases identified were bottom-up cases, hence it was important to understand the financing of these PPIs. Secondly, the PPIs did produce an aspect in infrastructure financing, which led to people financing. This objective provided an answer to the last sub-question of the research questions which was on how the PPIs were financed.

11.5.1 SUMMARY OF FINANCIAL ARRANGEMENT FINDINGS FROM ANT ANALYSIS

When listing the implications of objective 4, it was mentioned that coops in rural areas have the potential to finance wireless Broadband networks. The table below outlines the approaches adopted by each coop.

Table 11- 7 Identified Financial Arrangements in the Primary case

	Public	**Private**
Denmark	EU subsidy	Formerly
(Djurslandsnet)		100 DKK monthly subscription fee
		1000 DKK one time access fee
		Now Monthly fee has reduced to 60 DKK for some coops
		Some coops have no access fee
Sweden	Expenditure:	Coops:
(Almhult municipality/Zitius /Hallaryd coop)	Municipality funding (40 Million SEK)	20 000 SEK -25000 SEK one time access fee
	EU subsidy to coops covering half of coop digging cost	Annual coop membership fee

	EU grant for coops	Coop monthly payment for Broadband service used by its members
		Coop payment to municipality for materials needed
	Income	Zitius
	Coop monthly payment for access of municipality infrastructure	They are privately financed
		They are paid by municipality for services rendered to municipality and coops
India **(Airjaldi)**	None	Investor financing
USA **(Magnolia road Internet coop)**	Potential financing from the state of Colorado	Personal finances of the initiators Later financed with 300dollar loans from would be users Finally financed by membership subscription fee
South Africa **(JAWUG)**	None	Personal finances of the initiators Membership subscription
Wireless Ghana	None	Personal finance of John Atkinson NGO financing User subscription

Williams (2015)

The Danes, the Americans and the South Africans were income earners that could afford to pay as much as an average of 100 USD for access connectivity and a monthly subscription fee. However the Swedes living in rural areas are high income earners as they could afford almost 2500 USD access connectivity. In Ghana the highest monthly subscription paid was 50 Ghana Cedi (15 USD) and the lowest was 20 Ghana Cedi (6 USD). Some of the 20 subscribers were local farmers that earned approximately 100 Ghana Cedi (30) on a good day's sale. There were also civil servants, teachers and few educated people living in the area. In India, at the commercial phase, the major focus of the investors was anchor tenants such as rural schools, rural banks and local businesses. Hence, from rural areas in rich countries to rural areas in developing countries, money can be raised

11.5.2 IMPLICATION OF FINDINGS TO THE OBJECTIVE

- The financial plans of each case imply that each of the identified organizations or entities had to devise a financial plan that would fit their social context.

- In the case of the coops and NGOs, they knew their neighbors and the economic abilities of their neighbors. This led them to fix financial obligations based on the average economic ability of the people.

- In the case of the municipality, they had data on the general economic outlook of the citizens and they knew what they could afford and the incentives needed to make the people's investment worth the money they spent.

The general outlook of the financial arrangement of the cases, reflect an arrangement from the wealthy to the not-so wealthy countries. This implies that raising money from the rural populace is possible. It also implies that the government agency can also supplement on the money raised by the people.

11.6 OBJECTIVE 6

The next objective was to find out what factors affected the implementation process of the studied cases. This objective became necessary as a result of the organization of the cases. If these were mostly people led initiatives, what process led to them being organized. The cases were grouped into Public sector, developed and developing country cases with the aim of understanding the emerging patterns that led to the organization and implementation in each of the cases. This objective provided a lens by which the organization and the implementation of the PPIs could be seen from the bigger lenses of rural areas in Sub-Saharan Africa, developing countries and developed countries.

11.6.1 SUMMARY OF FINDINGS FROM GROUNDED THEORY

In identifying the factors that led to the implementation of Broadband Internet infrastructure, Grounded Theory was used to understand, the implementation process from the developed and developing country perspective as well as the public sector perspective. The findings are condensed in the table below.

Table 11- 8 Implementation Pattern in the Developing Country Cases

<table>
<tr><th></th><th>Causal factors</th><th>Intervening variable</th><th>Intervening variable</th><th>Intervening variable</th><th>Outcome</th></tr>
<tr><td rowspan="4">Developing country</td><td>vital resources</td><td rowspan="4">Intention to deploy</td><td rowspan="4">trial/mini-implementation</td><td rowspan="4">mobilization of critical mass</td><td rowspan="4">Implementation</td></tr>
<tr><td>Usefulness of technology</td></tr>
<tr><td>Usefulness of service</td></tr>
<tr><td>Accepted user need</td></tr>
<tr><td rowspan="3">Developed country</td><td>Vital resources</td><td rowspan="3" colspan="2">trial/mini-implementation</td><td rowspan="3">mobilization/ union</td><td rowspan="3">Implementation</td></tr>
<tr><td>Perceived usefulness of technology</td></tr>
<tr><td>Deployment possibilities of the technology</td></tr>
<tr><td>Public sector</td><td>The municipalities' decision to develop the infrastructure,</td><td colspan="2">Municipality Planning</td><td>Enrolment of partners</td><td>Implementation</td></tr>
</table>

	The Coops decision to partner the Municipality			
	The private sectors desire to invest			

Williams (2015)

Objectives 4 and 5 became clearer as the attempt to understand the process of implementation was studied. For the developing countries such as Ghana, South Africa and India, as seen in chapter 9, there was iteration once the facilitators of the project got to the mobilization stage. If they gathered enough people to sustain the economy, they organize and implement on a large scale. If they do not mobilize enough people to sustain their economy, they proceed to expand the network to where potential users would live. In this manner they were able to charge much less as identified in objective 5 and expand the network as well.

However the initiators or innovators of the process and future members of coops or users were motivated to join because of four factors identified in the process. These were:

- **Usefulness of the technology:** The innovators and future users in the developing country cases had to be convinced that the technology would provide the services they want.

- **Usefulness of the service:** The innovators and future users had to be convinced that the service delivered by the technology was delivered with good QoS in order to meet their wants.

- **Actual user need:** The innovators and future users had actual user needs, such as the need to communicate, the need to socialize, the need to be entertained and the need to be able to air their views. Commercial needs were very few. If the service delivered could meet the individual's need, then the individual signed up.

- **Vital resources:** The vital resources here are resources the innovators or users could not do without in the process of deploying and using the network. The resources identified were social resources (needed for mobilization of users), technical resources, human resources, financial resources, personal resources, external resources etc. The vital resources varied from case to case. Some vital resources were as simple as the intrinsic knowledge a person had to toy with technology without the person being a technical person. These resources varied. For example, the existence of graduates in rural areas, are potential human resources for developing wireless networks.

Once these factors existed, the intention to deploy became eminent and the mini-implementations, mobilization and organization emerged from there. Once they were organized, then implementation occurred.

In the developed countries of Denmark, Sweden and the United States, the case was different. Due to their already existing knowledge about the Broadband network (fixed Broadband in the case of the Swedish coops) and their already existing knowledge of the networks, they only had to perceive which of the Broadband networks will be useful to them. They all looked for deployment opportunities as well as gathered the needed vital resources. Hence, unlike the developing country cases, they did not need the causal factors to motivate them. The causal factors were as a result of their desire to deploy. So they had to figure out what they needed. Unlike the developing country case, they did not go around in iterations as a means of raising money, they had the numbers, they had the money, they had self-determination, mostly because there was the scarcity of the service or a threat to the existing service. This fact explains why they were able to contribute much more money than the developed country cases as seen in Objective 5. These causal factors led them to organize as seen in objective 4.

In the Swedish case, the process was driven by the public sector. The plans of the Almhult municipality towards fixed-Broadband infrastructure development would not have occurred in the way it did if it were not for the following factors:

- **The decision of the coops to partner the municipality**: The municipality's plan was centered on the coops accepting the municipality proposal. In some areas there were no coops, hence these coops had to be facilitated and incentives provided for them.

- **The decision of the private sector to invest:** The technical part of the Broadband facility was to be handled by the private sector. The possibility of earning a return for investment within the three year lease, made the partnership with the municipality enticing.

- **Municipality decision:** The municipality's decision to facilitate the fiber optic development was a crucial factor, else the other 2 variables would not have held. These factors led to the municipality planning how the three entities would work together and further led to the enrollment of each partner. The private sector was enrolled by a procurement process and the coops via information meetings. Once enrolled, the implementation process began.

11.6.2 IMPLICATION OF FINDINGS TO THE OBJECTIVE

The implementation process identified from the three processes provided inspiration towards how the organization and the financing of a Broadband infrastructure can be facilitated in rural areas of both developed and developing countries. The iteration process in the developing country perspective provides flexibility towards mobilizing people, raising funds of which people can afford and implementing the Broadband infrastructure. In rural areas of developing countries the wireless Broadband infrastructure would be preferable. However, what is important here is facilitating the causal factors. In Ghana and Nigeria and in some sub-Saharan African countries, the Universality finds have been facilitating capacity building programs in rural areas. One would say that the beneficiary of these programs does have an idea of the services. The existence of low cost, smart phones also present an opportunity for facilitating Broadband infrastructure in rural areas. However, if the people are to lead the way, they should be aided to understand the vital resources that they have. This is an area where the public sector should look into.

In the rural areas of developed countries, it is important that (just like the Swedish case) the right financial and technical incentive exists. This would aid the people invest in developing their own Broadband infrastructure. It is clear from this research that the sense of ownership of the infrastructure has been a big factor for people in the cases studied.This led the people to invest in the infrastructure. Here there is room for the private sector. Hence, the private sector does not necessarily have to own the facility; the Private sector can actually manage the facility for the people, supervised by the public sector. The fate of the private sector is decided by the people.

The implication for the public sector here is that, there should be a shift away from regulations that does not permit public agencies to facilitate infrastructure development. It is one thing to say the public sector should neither own, nor manage the infrastructure, but it is another thing to say they should not facilitate various forms of infrastructure delivery. They can in various ways facilitate, people owned infrastructure delivery, where people are involved. In rich countries fixed Broadband can be facilitated, in poor country’s wireless Broadband can be facilitated for a start. However, as data from Nigeria and Ghana portray an extensive fiber optics backbone development in both countries, if possible fixed Broadband infrastructure should be facilitated at a small phase.

11.7 OBJECTIVE 7

The next objective was to identify PPP or PPI possibilities from the financial point of view. This objective was also aimed at finding out where public help was needed and in what way? This was a way of beginning to identify public components that would lead to a stronger PPI and possibly PPP in Nigeria, Ghana and in a broader scale. In investigating the secondary cases, the challenges faced were mostly regulatory challenges, financial challenges and technological challenges.

11.7.1 FINANCIAL CHALLENGES

All the cases- aside the Swedish case that had public funding- sought public funding. This makes public funding an important vital resource. The reason the developing country cases such as the identified Ghanaian and South African cases underwent much iteration was because they had to raise funds as they expanded. Initially, they had to fund the projects from their personal resources. However, they were not able to get public financial support. This would have helped them go a long way. In the interview with the respondent for Wireless Ghana, he lamented their inability to attract public funding.

This was not a developing country problem alone, as the case of Magnolia Road had to do with the fact that their expenditure was below the state threshold for public funding. Djurslandsnet got EU grants and the Swedish case would not have moved at a faster rate without funding from the municipality and the EU.

These facts imply that there is room for the public sector in such ventures. There is also room for funding from International NGOs and International Development Agencies (IDAs) could as well.

11.7.2 REGULATORY CHALLENGES

The regulatory challenge was evident in the Danish case. In the Danish case, the coops could not get public support because telecom infrastructure development is only the prerogative of the market. In South Africa, the regulatory bottleneck was the inability to interconnect with PSTN. In Denmark, removing this clause may not be necessary; however removing bottlenecks to towards bottom-up approaches may be very beneficial in developing countries and in sub-Saharan Africa. In Nigeria and Ghana, such bottlenecks do not exist, hence trying out this bottom-up approach would be beneficial. However, it would be necessary to lower entry barriers for such coops in countries where there are high entry barriers to the market, and the exit barrier should be low. This is because the bottom up-initiative should be flexible.

11.7.3 TECHNOLOGICAL CHALLENGES

This was evident in the Danish and US case. This challenge is one of the reasons deployment possibilities was identified as a causal factor. In the Danish case, although they knew the usefulness of the wireless network, they could see it with the Walkie Talkie Network at Bovl. But they had no idea which wireless network to adopt. This led them to toy with the idea of adopting Fixed-line connectivity. When they decided to adopt wireless Broadband connectivity, they still had a challenge of how to route traffic. Although,they learnt network deployment by doing and self-development efforts, they had initial problems with routing traffic on the network. This they also had to learn by doing. They did eventually gain trust of the coop members when they could rout traffic successfully, hence deployment possibility was vital. Finally, the cost of equipment, although affordable for a trial was a challenge for massive deployment, hence they decided to fabricate some of the antennas.

In the case of Magnolia Road Internet coop, the presence of George Watson was a plus as he was technically inclined. However the challenged they faced was in the long distance connectivity as well as winter trials. The challenge was not in the setting up of the towers and equipment, but rather in ensuring QoS over a long distance.

11.8 OBJECTIVE 8

This objective identifies how the lessons learnt from the primary cases could supplement the efforts in Ghana and Nigeria? So far the following has been achieved:

- Identification of the type of PPIs in Ghana and Nigeria, using the Stakeholder Theory.
- Identification of the important stakeholders in the Broadband ecosystem using Stakeholder theory.
- Identification of the gaps in the PPI in both Nigeria and Ghana by examining the penetration level of Broadband in Ghana and Nigeria.
- Identification of other innovative external PPIs that could fill the access gaps not filled by existing PPIs.
- Identification of how these PPIs are organized and financed using the Actor Network Theory.

- Identification of the factors that led to the organization of the PPIs in the developed and developing country cases using Grounded Theory.

- Identification of the financial and regulatory challenges faced by the identified external PPIs

The application of the lessons learnt from the previous cases is divided into 3 parts for each case. The first part is the use the aforementioned list of achievements as a benchmark – which is a summary of the previous 7 objectives - to identify the possibility of a partnership between the public and private sector in both cases. The form of PPI that would likely emerge is identified. The role of both the public and private sector with regards ownership, design, building, maintenance and operations is also identified. An attempt was also made to identify affordability and risk factors. The second part is an attempt to identify if there are certain parameters for organization of the people in the rural areas of both countries that meet the parameters of the causal factors. The third part is to list the implications of the identified PPP and the causal factors aimed at organizing the people.

11.8.1 SUMMARY OF FINDINGS IN NIGERIA AND GHANA FROM STAKEHOLDER THEORY

In both countries, there are opportunities that points to the plausible fact that the identified PPIs could be "customized" to operate in both nations. The plausibility lies in the fact that there are opportunities for the organization of a PPI. The reasons for the plausibility are as follows:

THE EXISTENCE OF NON-TELECOM BOTTOM UP INITIATIVES

Nigeria: In Nigeria there is a premise for bottom up-initiatives. There are instances where poor villages have mobilized themselves to facilitate electricity and portable water infrastructure. This usually takes an average of about 4 to 6 years. This is done when they see the need for the infrastructure. This fact, the researcher experienced by observation of villages in southern Nigeria facilitating electricity from the bottom-up approach. Hence, aside coops, another vehicle for development exists in the village structures.

Ghana: The Wireless Ghana project is an example of the fact that people in rural Ghana can facilitate wireless Broadband infrastructure. There was another defunct case at Koforidua, still in the Eastern region of Ghana. Hence there is the possibility to facilitate such bottom up initiatives

THE EXISTENCE OF POSSIBLE VEHICLE FOR RURAL ORGANIZING

Nigeria: As mentioned in the first point, the village structures serve as a tool for organization. NGOs and coops are other potential tools for organizing. However the village structure is more organized. It is important to note that some village councils are poor; however, these rural areas can raise money over a period of years. They can liaise with local municipal councils that can supplement their money raising effort. However, at this juncture, it is important to note that villages that are without commercial value or too poor might require NGO support.

Ghana: In Ghana rural social structures such as Village council institutions exist as well. In the case of the Wireless Ghana Project as mentioned in the interview in appendix B.2.3 when the NGO was losing grasp of the wireless Ghana project, the village chief and the village council were willing to take over the project. Unfortunately the NGO and the Village could not come to terms. This is an indication that the village, on experiencing the usefulness of the technology and the usefulness of the services they were using were able to identify the services they actually needed. In the stakeholder analysis as well, NGOs were identified as partners with GIFEC. Coops, as identified in the primary cases are possible vehicles of the organization. However, such coops have to be facilitated.

THE PUBLIC SECTOR IS WILLING TO PARTNER WITH CIVIL SOCIETY

Nigeria: In Nigeria, Broadband coops were not identified in the course of the research. This does not mean that it may not exist. However, NGOs were identified as stakeholders that are dependent on the USPF. The law mandating the USPF permits the USPF to partner with any stakeholders hence coops and other social organization could be partnered.

Ghana: The public sector is willing to partner with civil society as mentioned in the previous point. They already have collaborations with NGOs as mentioned in chapter 10.

EXISTING PARTNERSHIPS BETWEEN THE PRIVATE SECTOR AS DISCUSSED EARLIER

Nigeria: Findings from the USPF indicate that they control the implementation of the fixed or Broadband infrastructure they facilitate. Hence, one would say that the USPF can, just like the case of Almhult municipality, moderate private sector participation in the PPI.

Ghana: Ghana's case is similar to the Nigerian case; the only difference here is that in some cases GIFEC handles the infrastructure development alone. GIFEC needs regulation that would compel the private telecom network operator to use their infrastructure or alternatively adopt the Private DBO.

THERE ARE GATEWAY POSSIBILITIES FOR BROADBAND ACCESS TO RURAL AREAS

Nigeria: The current development of the rural backhaul provides connectivity possibility for the development of village access networks or coop networks that would interconnect to the rural backhaul network.

Ghana: The extensive private development in the facilitation of a fiber optic backhaul network by the Mobile network providers provides an opportunity to create a wireless Broadband network in rural areas.

THE USPF AND GIFEC (PUBLIC SECTOR) ARE WILLING TO ADOPT BOTTOM-UP INITIATIVES

Nigeria: The finding points to the fact the USPF in Nigeria is eager to facilitate rural Broadband connectivity in general as well as adopt bottom-up initiatives.

Ghana: In an interview with the communications manager of GIFEC, they are willing to accept bottom - up initiative ideas if there is an evidence of its efficiency somewhere else.

11.8.2 EMERGING PPI MODELS FROM FINDINGS –PLAUSIBLE BOTTOM-UP PPI ORGANIZATION AND FINANCING ARRANGEMENTS FOR GHANA AND NIGERIA

The reason for developing a combined framework for both cases is not to indicate the universality of the framework. Rather, it is because of the similarities in the plausibility found in the summary of both cases. The ideas influencing the overall organization of this bottom-up initiative are influenced greatly by the way the Almhult municipality Broadband Initiative is organized. However, the idea influencing the organization of the civil groups is from the cooperative cases. The idea influencing the choice of infrastructure ownership, financing, design, maintenance and operations is influenced by the cooperatives studied in the primary cases, analyzed with ANT. The choice of stakeholder is influenced by the list of important stakeholders identified earlier in the report using Stakeholder theory. This list was compared to the emerging list of actors identified in the ANT to provide a list of possible actors in the organization of the PPI.

Based on this background, two possible organization approaches were identified. These arrangements were the PPP arrangement and a PPI arrangement. The PPP arrangement is not named because it provides an overarching framework that can be tweaked depending on the circumstance. The PPI arrangement is called the Municipality Mediated Model.

PUBLIC PRIVATE PARTNERSHIP MODEL ARRANGEMENTS

Proposed PPP infrastructure: Based on the identified stakeholders in both countries as well as stakeholders identified in the different primary cases, a Public Private Partnership to develop wireless or fixed-Broadband infrastructure can be facilitated between the public and private sectors (non-profit and profit making sectors). However, due to the socioeconomic conditions of the rural areas in both countries, it would be preferable if they stick to developing Wi-Fi Broadband networks. The cases studied, especially in the developing countries indicate that people in rural Africa, if trained could develop their Wi-Fi infrastructure and upgrade it. On the flip side of the coin, it is also possible that knowledgeable people are not found in some rural areas. Here the outsourcing of the infrastructure to the private sector or training of the rural populace would be advisable. The training is easier for Wi-Fi networks as seen in the report.

In developing the framework, the foundation of the arrangement based on the inspiration from PPP frameworks, mentioned in chapter 4, will be either a variant of Design-Build-Operate (DBO) or a Design –Build – Finance - Manage – Operate (DBFMO). The variants of DBO can be implemented in both developed and developing countries. DBFMO will not be possible in core rural areas of developing countries, as they would not be able to finance the infrastructure alone. This fact then makes DBO a foundation that could be built upon in both developed and developing countries. This is because, the financial and management aspect of DBFMO can be outsourced. The choice of these two is based on the assumption of this report that the private sector could be the profit and non-profit private sector. Hence , from this standpoint, the results of the primary case studies have shown that the non-profit private sector can indeed Design, Build, Finance, Manage and Own the infrastructure. Based on the view of the private sector and fact from data, an over-aching DBO and a DBFMO is proposed as a foundational framework. The overarching nature of the proposed framework that will be presented shortly, provides the flexibility of creating variant forms of DBOs such as Design Build -Operate -Maintain (DBOM), Design-Build-Operate-Own (DBOO), and private DBOs. Public DBO unfortunately cannot be prescribed for this framework, as the public sector will end up owning the infrastructure which is against the tenet of this research. Before proceeding to explain the stakeholder relations in the PPP/PPI framework, proposed in this research, it is important to state that the PPP/PPI framework is neither a DBO nor a DBFMO. These PPP arrangements were inspirations. Rather the framework is an over-arching relationship between the public, profit making private sector and the non-profit making private sector. The only constant is the ownership of the infrastructure by the non-profit making private sector. The other responsibilities will vary from one national jurisdiction to another.

Stakeholder responsibilities and partnerships: The relevant stakeholders needed for the PPP are identified in the table below. In this form of PPP, the private sector is grouped into Profit and non-profit making Private sector.

Table 11- 9 Relevant Stakeholders Needed for Rural PPPs/PPIs in this report

	Public	Private (non-profit)	Private Profit (Profit oriented)
1.	Universality fund (USPF, GIFEC)	Broadband Cooperative	ISP
2.	Any public institution	NGO	Telecom network Operator
3.		Village council	Telecom infrastructure provider
4.		Social enterprise	Broadband infrastructure provider
5.		International NGOs	Broadband Service provider
6.		International Donor agencies	

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In facilitating the PPP, it is important to identify who will own the infrastructures, who will either build, design, manage, maintain and operate the infrastructure. On an important note, it is important to identify who would finance the infrastructure as well as the source of revenue for maintaining the infrastructure. The table below showcases a proposal of responsibility sharing between the public and private sectors.

Table 11- 10 Potential Responsibilities for Each Stakeholder in a Rural PPP/PPI

	Design	Ownership	Building	Management /Operations	Maintenance	Finance
1.	Non-profit private (people)	Non-profit private (people)	Non-profit private (people)	Non-profit private (people)	Non-profit private (people)	Non-profit private (people)

2.	Public sector (Universality fund,)	Private sector	Private sector	Private sector	Public sector (Universality fund,)
3.					External funding

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Infrastructure Ownership: In facilitating the PPP, it is important that the infrastructure is owned by the people. This will create a sense of ownership for the people and also facilitate the moral courage to maintain the infrastructure. The people should be empowered to drive the process. It is important to note that the NGO should not own the infrastructure - if it is not an NGO organized by the people in the area. If it is an external NGO, its duty should be to facilitate coop formation.

Infrastructure Building: The building of the infrastructure should be done either by the Non-profit private sector in partnership with the profit making private sector. The reason for this is because, there is a need for technology transfer to aid the people or organizations in the rural areas develop and expand their network over time. The case of the Almhult municipality indicates that this is possible for fixed and wireless Broadband networks. The difference here would be that a rural dweller in Nigeria and Ghana would not afford the 2500 USD access fee. In the case of wireless networks, the technology transfer is also important.

Infrastructure design: The infrastructure can be designed by the USPF or GIFEC, the private sector or the people. If it is a wireless infrastructure, then it should be managed, preferably, by the people. The private sector can grant technical aid and training where necessary.

Infrastructure management and operation: In the case of a wireless infrastructure, it would be wise if the non-profit private sector manages the infrastructure. However, in the case where the Non-profit private sector can bear the service fee, the profit making private sector entity can either lease the infrastructure for a fixed number of years, or management and operation of the infrastructure can be leased to the private sector. The lease agreement could be facilitated by the USPF or GIFEC on behalf of the people. This should be done by the universality fund owning a list of trusted and viable infrastructure and service providers with terms and conditions with regards managing rural infrastructures. When the people are in need of the private sector, they will contact the universality fund who will access their financial strength and advice on which infrastructure provider to choose. Once the people choose an infrastructure or service provider, then they can go into a formal agreement with the infrastructure or service provider. The outsourcing should not be more than 3 years. The Universality fund can decide it should be a renewable contract or otherwise. Most importantly, there should be a representative of the universality fund and the host rural area on the board of the private sector. This is necessary, but not in all cases. The universality fund will monitor the partnership and act as a dispute resolver. However, it will be preferable of the non-profit private sector hires workers or volunteers to operate and manage the infrastructure. In the case of a village, they could set up-a mini village coop to manage it.

Infrastructure maintenance: This can be facilitated by the non-profit private sector in the case of a wireless infrastructure. They can use volunteers or paid village workers. The non-profit private sector can also pay the profit making private sector to facilitate periodic maintenance of the network. On the long run, there should be training for the local people.

Infrastructure financing: Here we discuss the affordability factor. The financing should be facilitated jointly between the Universality fund and the people. If there is the possibility of getting extra funding (such as national budgeting or international donors) that would not be a liability to the people, then this is also advisable. The reason people have to pay is because they own the infrastructure. The source of income from the people includes: forward setting of membership fee, access fee etc. for the project. In the case of a village it could include the village buying cash crops from the local commercial farmers and selling it at wholesale to the outside world and the money could be used to finance the infrastructure. In the Grounded Theory analysis, the developing country model led to iterations aimed at raising funds. This implies that raising money takes time. Hence rural dwellers should be given time to raise money. However, the people should be told how much they need to pay to facilitate the infrastructure, how they raise the money should be at their discretion. The revenue should be user pay. This is a shift in financing from conventional PPP financing, such as Project financing using SPVs and corporate financing as mentioned in chapter 4. This shift was deliberate, as the projects would be a waste as the private sector will not be able to earn Return on Investment in the long run in rural areas, if these funding mechanisms are adopted. This is why the only importance of the profit making private sector, if needed, is their expertise and efficiency. Funding is primarily from the Government agency, International Donor Agencies (if possible) and primarily from coops (especially in developed countries).

Based on the above description, the emerging PPP framework can be seen in the figure below.

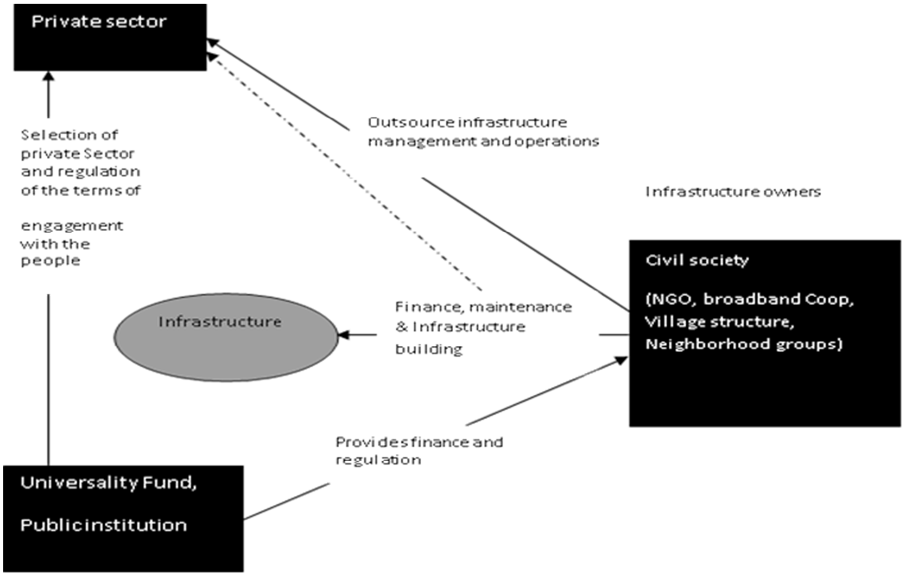

Figure 11- 1 PPI Framework for Rural Broadband Development

PROPOSED RESPONSIBILITIES FOR THE PRIVATE SECTOR, PRIVATE SECTOR AND THE PEOPLE IN THE PPI MODEL

Regulation: The regulation will be provided by the public sector.

Risk Distribution:

As regards to risk management, as mentioned in objective 1, the regulatory and political risk in Nigeria and Ghana towards PPPs is low. Based on the findings in this report, both countries are market oriented countries. Hence there is no risk of nationalization or expropriation, unless there is a military coup. So far, since the last part of the last century till date, both countries are pro-liberalization; secondly, they also have a track record of market facilitation in the development of telecommunication infrastructure. Hence the proposal in this report is just an extension of what they were doing already. Hence developing and implementing the regulatory framework for such a PPP is possible.

Potential commercial risk: The commercial risk comprises of the supply side and demand side risks

Supply side risks: the supply risk will be borne greatly by the universality funds of both countries as they may contribute more to the project. However the technology risk factor for wireless Wi-Fi Broadband infrastructure in poor rural areas would reduce the deployment feasibility, risk burden and enable the multiplicity of such projects. However, in rural areas in developed countries where high income earners live, Fixed Broadband can be facilitated if the feasibility risk is low.

Demand side risks: On the demand side, since the revenue is user pay, then the non-profit private sector would have to bear the risk of facilitating demand. The universality fund or relevant public authority shares a smaller burden via capacity building.

On a final note, as the penetration of Broadband Internet is low in both countries, the universality funds can serve as a catalyst for gathering people. Information meetings, etc., could be a way of doing so. The universality funds would have to divide the country into zones to facilitate such project in batches. This may take time as finance is a scarce resource. Hence this PPP initiative should only be facilitated in rural areas where there is no form of Broadband connectivity and where the market may not reach.

MUNICIPALITY MEDIATED MODEL ARRANGEMENT

This model is a coop facilitation model. It is a plausible model for facilitating Broadband Infrastructure in rural areas where demand does not exist at all, the education level is low and social amenity is almost absent. This model involves using local Governments (Municipalities in both countries) to facilitate the organizing and training of Broadband coops in rural areas by the Universality funds. Here the co-ops would be trained in building and managing Wi-Fi networks as well as how to raise money. Successful coops can then apply for funding from USPF once they can gather the threshold needed to partner with the USPF. In this case the USPF provides a fixed amount to the coops via the municipality as subsidy for facilitating the network. Accountability will be provided by the coop to the municipality and the municipality to the USPF. Quality assurance would be monitored and determined by the USPF. Private sector involvement may or may not be necessary as seen in the diagram below.

Figure 11- 2 ***Municipality Mediated Model***

The role of the municipality in very poor countries would likely be to mobilize the rural people. The implementation framework identified using the Grounded Theory serves as a tool for guiding the people through the implementation process. In a developed country, the municipality may provide funding as well, depending on their interest. Still in very poor countries, the municipality mediated model can serve as a prelude to the main PPI model seen in figure 11.1. In this case the municipality serves as a provider of the Broadband consciousness through trainings aimed at leading people to identify the relevant vital resources, and the usefulness of the technology and service. Such training will have to be customized to the needs of a specific rural area. Once the people in the rural area have been able to grasp the concept and own it, then they could be recommended to the relevant public authority to have the infrastructure developed.

11.8.3 PLAUSIBILITY FOR THE ADOPTION OF THE PPI MODELS IN GHANA AND NIGERIA

Having identified the plausibility of PPP and PPI being organized and financed in Nigeria and Ghana from the bottom up approach, the question now was, were there evidence that the Non-profit private sector in Nigeria and Ghana had the potential intention to deploy Broadband infrastructure? Adapting the developing country model identified in this report, an attempt was made to see if there is the plausibility for the constructs holding in rural areas in Nigeria and Ghana. It is important to note that rural areas in both countries vary from region to region and state to state. Hence this assessment is not representative of rural areas in each country, rather it is an attempt to place the findings of this report into the developing country model. This is a sample of how it could be utilized. If a universality fund is to access the intention to deploy factor in a particular rural area, then the research into the causal factor has to be carried out per rural area.

Table 11- 11 Possibility of the Grounded Theory Models Working in Ghana and Nigeria

	Nigeria	**Ghana**
Usefulness of Service	A research should be conducted to find out what the people have and what they can do. In areas where people do not know the usefulness of the technology and service, then some training may be needed. However the case of the wireless Ghana project has shown that the telecentre projects of previous universal access initiatives has led to latent computer literate citizens. Finally, some computer application that is useful to the day to day live of the people should be adopted to create an initial user need that will act as a driver for people to come on board. For example, electronic voting could be an example,	The wireless Ghana project, just like the Nigerian case exposed the fact that there is latent demand based on the fact that telecentres existed in some areas of Ghana. People were trained in these telecentres. GIFEC just like the USPF have facilitated ICT capacity building over the years as indicated in chapter 8.
Usefulness of technology	A research is needed to determine this variable in Nigeria	Although people use mobile phones in rural areas, they do not know about the technology. For them it is complex. In the Ghana Wireless project, people had to be taught about the usefulness of the technology to them before they could sign up. In rural Ghana, it would be necessary to conduct training on the usefulness of Wi-Fi technology and how it can be facilitated.
Vital resources	**Financial resources**: From the Nigerian case, the USPF have the financial resources to facilitate bottom-up approaches in phases. They can decide to do the implementation in phases. Aside the USPF, the central Government and the government agencies are willing to invest in the	**Financial resources**: There are some potential funding possibilities from the civil societies. There is also funding possibilities from international NGOs, as identified in the stakeholder analysis. Hence public funding from GIFEC

	development of Broadband infrastructure, once they can see the need for it. The search for financial resources is where PPP may come into play. Public participation in a form of PPP could come in the form of financial and regulatory contributions. Regulation could occur via providing incentives to private investors joining the project or for the coop or village structure joining the project. The people should sense ownership of the project	would supplement such financial initiatives. However, as proposed in this report and as seen from the Ghana Wireless project, funding can come from the people.
	Human resources: Many Nigerian graduates and retired public workers live in rural areas. Most of these graduates are technical graduates or people who can be innovative. Drawing from the case of Djurlandsnet, magnolia road internet coop, JAWUG and Airjaldi, one can say that these individuals are untapped human resource potentials who could be useful in developing such infrastructure, mostly wireless Broadband.	**Human resources**: Just like Nigeria, some Ghanaian graduates as seen in the Wireless Ghana Project live in rural areas. This implies potential manpower that could be trained to develop wireless Broadband networks. This implies that there is human resources. Coops, ICT NGOS and village council could raise funds that would be used in developing the wireless infrastructure.
	Social Resources: Rural Nigerians are social people, which belong to a local social group or the other. They are also social in the sense that people know their neighbors and they have close knit extended family systems. As mentioned earlier, they owe their allegiance to traditional rulers or village chairmen. Hence this social resource is very vital in gathering and organizing people. People here are also willing to donate for commercial good.	**Social resources**: The Ghanaian social system is the same as that of the Nigerian social system in rural areas. There is variance if cities in both countries are compared. Hence, based on the social attributes, the people can galvanize themselves towards affirmative action in facilitating Broadband internet infrastructure
	Technical Resources: The lessons learnt from Djurslandsnet and the	**Technical resources**: In the case of Wireless Ghana, the

	Magnolia Road Internet coop points to the fact that some Wi-Fi equipment like the antennas can be fabricated locally. In rural Nigeria, this is a possibility. Secondly, the existence of local technical hands as well as the need for less equipment to facilitate wireless infrastructure is a possible technical resource. In a place where these technical skills are lacking, it is possible to train volunteers in these rural areas as to how to go about it. On the other hand, in the case of a PPP, the private sector can facilitate the development of the infrastructure and manage it on behalf of the people. Hence the private sector can provide the technical resource.	technical resources were provided both by the end user from the Customer premises end and by the supplier at the transmission end. However, in this report, it is believed that some of the needed equipment can be fabricated locally.
Actual Usefulness	In the developing country cases, this was determined in some cases as a result of some pre-trial of the technology in a small scale. In some other cases, the users actually knew beforehand how the technology would be useful to them. However, in this report, that data does not exist, hence it would be important to carry out a pre-test in rural Nigeria to know what people would actually use the service for.	In the Eastern Region of Ghana, where the wireless Ghana case existed and in areas where the case became defunct, one can infer that people over there actually know what the service could do for them individually. This is important because the service does not have to be a luxury but a necessity. However, in other areas where such networks did not exist. Pre-tests has to be carried out

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In both cases, all the causal factors identified in the developing country model have not been fulfilled, hence the intention to deploy Broadband Infrastructure in rural areas in both countries is either low. Hence, the intention to deploy cannot be harnessed. It is difficult to say that the intention to deploy is not existent as, such an intention could be repressed or latent. The reason for the repression could likely be that they have other basic amenities they consider more important than Broadband internet services. Although the discussion in the tables is developed on a cautious note, assuming that most rural areas in both countries do no have access to

Broadband Internet service, it is important to note that some rural dwellers visit the cities and could know about the usefulness of the technology as well as the usefulness of the service. They may as well know about the actual usefulness of the internet to them. However, as mentioned in the table above, research is needed to verify this.

However, the existence of the Ghana Wireless project for the Ghanaian case is a testimony to the fact that the identified causal factors were valid for their case. However, the in the table above, the fact that the Ghana Wireless Project succeeded for a while does not mean that most rural areas have the intention to deploy. The Ghana Wireless project is a one off project. However, the Ghana Wireless project as mentioned in the table above is a testimony to the fact that the Village structure would be interested in facilitating Broadband internet infrastructure.

In summary, one would say that the identified causal factors for the developing country model needs to be tested for validation in rural areas of Ghana, Nigeria and any developing country. If the model stands, then it can be identified as a theory. If it can be tested in several rural areas in developing countries in different parts of the world and it remains valid, then one would say that this model can be used to facilitate coops or organization of people to facilitate Broadband internet service.

However, if the factors were to be fulfilled, then one would say that there is an intention to deploy which can be tapped.

11.8.4 IMPLICATION OF LESSONS LEARNT FOR NIGERIA AND GHANA

The lessons learnt in the bid to draft a PPP framework as well as test the developing country model for organizing people, it was clear that there was an opportunity for the facilitation of the bottom-up approach in both countries as seen in the table below.

Table 11- 12 Implications of Overall Findings on Ghana and Nigeria

	Nigeria	Ghana
Possible adoption by Public sector	There is the plausibility of the form of PPI being proposed could be adopted by the public sector (USPF)	There is the plausibility of the form of PPI being proposed could be adopted by the public sector (GIFEC)
Possibility for a bottom-up PPP	It is possible to develop a case by case PPP depending on each rural area centered on the people owning the infrastructure	It is possible to develop a case by case PPP depending on each rural area centre on the people owning the infrastructure
Financing possibilities	It is possible to finance the PPP and PPI from cash inflows from the people and the universality funds	It is possible to finance the PPP and PPI from cash inflows from the people and the universality funds
Technical possibilities	The bottom up PPI will support a Wi-Fi wireless network. Heavy funding will be needed for fixed Broadband access network	The bottom up PPI will support a Wi-Fi wireless network. Heavy funding will be needed for fixed Broadband access network
Rural Gateway Access possibilities	There are existing backhaul fiber optics networks that can provide connectivity to the rural access networks	There are existing backhaul fiber optics networks that can provide connectivity to the rural access networks
Municipality partnership possibilities	There is the possibility of facilitating a PPI involving the municipality, but it may require a regulatory framework	There is the possibility of facilitating a PPI involving the municipality, but it may require a regulatory framework
People organization possibilities	The developing country model shows signs of producing the intention to deploy by the people if the people find the network and service useful as well as know how they can actually use it daily	The developing country model shows signs of producing the intention to deploy by the people if the people find the network and service useful as well as know how they can actually use it daily

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However, these possibilities are only proposals until they are tried out.

END OF FINDINGS AND ANALYSIS SECTION

CHAPTER 12. DISCUSSION

12.1 SUMMARY AND SIGNIFICANCE OF KEY FINDINGS

The broad aim of this report has been about Broadband infrastructure development in rural areas. In this report, it is accepted that rural areas vary in different countries as well as in developed and developing countries. In this report two PPI models have been proposed. The first proposed model is the PPI arrangement involving the public sector, the private sector and non-profit private sector (organized peoples' groups). The second proposed model is the municipality mediated model. The second model is proposed for rural areas that are extremely poor. These models are not fixed frameworks, but flexible frameworks with few constants. The flexibility implies that the public sector can decide on the role of each partner without shifting the constant (ownership), depending on their environment. These models provided an answer to the research question of this report.

Infrastructure ownership lies with the people, this report has provided suggestions on how to mobilize people in rural areas of developed and developing countries to develop Broadband infrastructure in their communities. This was made by identifying how current standalone people-led Broadband initiatives in developed and developing countries aimed at developing fixed and mobile Broadband Internet infrastructures were facilitated. The PPIs as identified in all the cases, except that of Almhult Municipality Broadband Initiative in Sweden, are mostly loose collaborations between the public sector and the non-profit private sector. Two models emerged from this exercise. The first model was the developing country model and the second model being the developed country model. The aim of the model was to propose a roadmap towards facilitating rural dwellers to take up the challenge.

Although, these models in theory could be adopted for both fixed and wireless Broadband solutions. The recommendation is that the model should be used for Wi-Fi Broadband solutions in rural areas where the level of economic viability is very low and people live below $2US a day. However, in rural areas where people can afford more expensive infrastructure, then they are free to deploy either fixed or any wireless Broadband solution. However, the technology feasibility decision should be handled by the public sector if the people do not know what they want.

There have been researches on people - led models, both with respect to PPI and PPPs as well as Broadband infrastructure development. Research in this area has been focused on the top-to-bottom approach of infrastructure development as well as PPIs and PPPs (See (Nucciarelli, Sadowski, & Ruhle, 2014) (Kushida, 2013) (Feijoo, Gomez-Barroso, & Bohlin, 2011)). However, with regards bottom up-models, research in this area has also been focused on the role of community Broadband networks in the facilitation of Broadband networks (see (Hudson H. , 2014) (Salemink & Bosworth, 2014) (Tapia, Powell, & Ortiz, 2009). Research has been conducted on the role of the municipality in the facilitation of Broadband infrastructure (see (Tapia, Powell, & Ortiz, 2009) (Lindskog & Johansson, 2005)). Research has also been conducted on the partnership between coops and municipalities in facilitating Broadband coops (See (Salemink & Bosworth, 2014) (McMahon, et al., 2014)). However, research aimed at facilitating people or grassroots involvement to develop their own infrastructure within a PPI/PPP framework is rare. This is where this report attempts to fill the gap in research as well as stir up academic discussion in this area.

The overarching PPP/PPI models as well as the models aimed at facilitating grass roots involvement are grounded on the fact that these models are extracted from real life cases. One would say that the primary case studies of this report provided inspiration as to how the overarching models could be organized and financed. They also provided an inspiration on how the model aimed at organizing people could be facilitated. Thirdly, in the secondary case studies involving Nigeria and Ghana, their existing passion towards rural Broadband connectivity and their openness to new ideas - if practicable- presented possibilities for these models to be tested. If the models work, it can be adopted if found relevant to the cases in the secondary case study in this report or any country that wishes to adopt the model.

The important question one might ask is what is the significance of these findings? The significance can be viewed in terms of:

The Evidence of Backhaul Connectivity: In different parts of the world, as mentioned in the literature review in chapter 3, globally there is a lot of investment in the extension of national Broadband backhauls by the network operators and infrastructure providers. Hence, Broadband access connectivity is drawing closer to some section of people living in the Broadband access gap areas. In Nigeria and Ghana, the secondary cases, the universality funds are facilitating fixed and wireless Broadband infrastructure access respectively. Rather than wait for the private sector to develop the access networks, the people can take advantage of this opportunity to create Broadband networks for themselves while waiting for the private sector push from the cities.

Broadband infrastructure affordability: The greatest significance of this report is that the high cost of facilitating Broadband infrastructure is relative to the infrastructure. This implies that different rural areas can decide on which Broadband infrastructure they want. The Wi-Fi recommendation is a threshold for the poorest of the poor. This recommendation is made because the majority of the rural Broadband networks around the globe use Wi-Fi networks. It is difficult to insinuate that Wi-Fi networks are cheaper; however, one would say that people in rural areas as seen in this report can facilitate the network in ingenious ways by fabricating some of the equipments themselves. However, the findings made when developing the developing country model for the people portrayed the iterative nature of simultaneous infrastructure development and the raising of financial resources. As people saw the infrastructure and could understand its usefulness, they signed up to be connected. In this way demand was prompted as supply was taking place. Here one would say that the people in rural areas over time, taking the process one step at a time can jointly pay for the infrastructure with external funding from the Universality funds.

Feasibility of Infrastructure Choice and Deployment: Based on the potential of backhaul connectivity and possible infrastructure affordability, the variance in the social-economic make of rural areas globally, people in rural areas can make a choice of what to deploy. In this report the choice of deployment varied from the deployment of FTTH in Sweden to the deployment of Wi-Fi in other cases. In the Indian case, they were ingenious in their source of energy by adopting solar power for their cell sites. This was due to the periodical fluctuation of energy from the nation's electricity company to the area. In Denmark, rooftops are used as the antenna cell site for omnidirectional antennas. Each cell site served the surrounding houses. One out of every three houses has a directional antenna, which provides a wireless mesh backbone. The connectivity for the network is from Fiber optic connectivity provided by TDC. In other cases they had different vital resources that were utilized. These examples provide inspiration to the framework and models of this report. It leads to the conclusion that people led initiatives are feasible.

Facilitating Rural Adoption of the Idea: Another significance of the report is the attempt to identify drivers that would lead people in rural areas to adopt the idea. Although these drivers or causal factors for implementation cannot be touted as theories, one would say that it is a starting point for discussing how people in rural areas can be mobilized to develop Broadband internet infrastructure in a PPP. On the other hand the model reveals other possibilities for rural Broadband infrastructure development. These possibilities are listed below:

- The possibility of the people to adopt Broadband infrastructure facilitation, if there is the opportunity to spread the cost of deployment over time.

- The possible adoption of the infrastructure development in phases and in bits and pieces than as a whole.

- The possible adoption of Broadband infrastructure facilitation by the people if the identified causal factors in this report are harnessed. These factors in some rural areas have to be facilitated. Hence, this calls for training of the rural dwellers in developing countries on the usefulness of the infrastructure, the usefulness of the service, the actual usefulness of the service and the aid in identifying vital resources. In the developed world, people in rural areas will be willing to facilitate Broadband infrastructure if they have the vital resources, they know how the infrastructure will be deployed and if they have the need for the technology. Unlike the developing country case, the people in the developed world already know about the service. Here the universality funds could embark on trainings of the people. In countries where no universality finds exist, the relevant Government agency can handle this.

- The possible adoption challenge is with regards the identification of vital resources. In this research, it was realized that the resources identified as vital are not constant. This is as a result of the differences in the social, economic and personal context in different rural areas. It is also possible to note that identifying a potential “nerd” who has not tried his or her hands on anything at all could be difficult. One cannot write of the presence of retirees and rural educated people. However, a way of going about it could be to conduct technical training in these rural areas and allowing the people to be innovative and not stuck in the box of what they are taught. However, careful observation of people, traits, potentials as well as artifact possibilities should be made. Artifact possibilities include scrap metals, spare parts of old laptops, etc. Rather than buy new transistors, one could get one from a scrap. For example, in the Indian case, Yahel used wireless cards extracted from laptops in those days to configure a wireless router. These could save cost. Another way of researching into this is to contact existing rural Wireless Broadband group to learn from them. That knowledge is a vital resource.

The New Role of the Private Sector: The aim of this report was not to provide a new role to the private sector. Rather, it was to facilitate a market in which the private sector could invest later. However, based on the findings, it was clear in the Swedish case and in the Magnolia Road Internet coop case that the private sector does not need to facilitate infrastructure delivery. The Private sector can manage the people’s infrastructure. The OnsNET Nuenen’s case is not rural; however, in that case, the private sector was also employed to manage the infrastructure. Hence this finding is not new; rather it is being stretched to become a part of a public policy approach. If the private sector is not sure of gaining return on investment, then their efficiency can still be brought to bear in management and operations. This will bring relief to the organized peoples group from bothering about the daily technical details of their network. However the proposed PPP model gives room for joint management between the private sector and the people as well. This is because of the ability of the people to manage the network themselves, if they can. However, the proposal here is short term management lease contracts to the private sector-if needed. This gives the people the chance to try different service providers. The role of the private sector may just be the maintenance of the infrastructure. However, that should be left for the people to decide. If a particular Broadband provider is lucky, they may end up managing 3 or more rural infrastructure.

PPI possibility: As mentioned in the previous chapter, most of the primary cases sought for public help. They had regulatory challenges and financial challenges. Although they overcame some of these challenges, the findings in the report show that there is room for Public Private Interplay aimed at rural Broadband facilitation. If the public sector takes the bottom-up approach seriously, then different ways by which the public sector can aid the aspiration of determined people should be looked into. One can ascribe this lack of foresight to the moribund nature of the African cases. Probably the ITU, World Bank and other International Donor agencies could act as drivers spurring governments around the world to copy the Swedish example of direct public aid.

Regulatory implications: Based on the previous point, it is glaring that the PPI models proposed in this report will need regulatory backing in some countries. Some countries such as Denmark, do not own a Universal Service fund. Hence it is important to identify which agency could facilitate such a model in its rural areas. In the United States, Universal Service is facilitated by the FCC. Hence, if this approach is to be adopted, it needs a public sector referee who will serve as a buffer between the people and the private sector. If public funding is to be disbursed, where should the funding emanate from and who manages it. Aside the administration of the PPI models, there should be regulations that grant people the right to establish such infrastructures as well as provide incentives that would make the Private sector willing to participate in the scheme. There will also be issues with interconnection between coop networks and between coop networks and the public or private infrastructure. These are examples of the fine details that need to be ironed out country by country. In the primary cases studied, the results shows that they have the structures to manage such an idea. However the same cannot be said for many other countries. Hence unique regulatory regimes should be established for these models.

Market implications: Significance to the findings of this report is the validating of the people as market players in the provision of Broadband infrastructure. Over the centuries as seen in the literature review, people via coops have been an unrecognized player in the telecommunication industry. As a result of this fact, rarely are market incentives targeted at them to facilitate supply of telecommunication infrastructure. To reduce the capital expenditure even further for the rural people, people organized networks, especially in poor developing countries should buy the Terminal equipment and Customer Premises Equipment (CPE for the demand end) at a subsidized rate. Alternatively, import duties and taxes on the equipment, for them, should be removed or reduced if possible. Interconnectivity rates to access the private sector or Public sector backbone should be subsidized by the public sector for a limited number of years to enhance the take-off of the project. This would imply innovative business modeling on the part of the public sector. This is very important because the monthly cost of bandwidth is a potential threat to such networks. Hence the public sector has to intervene. One way of doing it could be to provide certain relief incentives to the private sector to compensate for the low interconnectivity charges.

Possibility of Bridging the Access Gaps: The facilitation of Broadband infrastructure in urban and semi-urban areas by the market forces is not in doubt. Hence, although this model could be applied to increase capacity in urban and rural areas (if in developed countries), it is more suitable in reaching out to rural areas where market forces will either not serve or no serve quickly. The current rapid upgrade in both fixed and wireless network technologies pushes Broadband and NGN development more towards urban and commercial centers. Many incumbent network operators, most at times, do not break even when a new company with superior Broadband technology enters the market. This leads the network operator to abandon the march towards the rural area to fortify their market share in the urban centers. This leaves the people in the rural areas with either obsolete telecom networks (if in a developed country) or either no network or network with poor QOS (if in a developing country). Hence, this people facilitated PPI arrangements can enable bottom-up approaches leading the march towards the cities at least in theory.

Implications for Universal Service: The overall significance of the findings is that PPIs can also enable the facilitation of Broadband infrastructure in rural areas of both developed and developing countries. If the rural areas can boast of Broadband connectivity and the cities can boast of the same, then Universal Access is achieved within a geographical area. One would say that the identified model is a supplement to other universal access Initiatives as well as PPIs.

Based on this significance among others, one can say that the findings in this research provide food for thought in the adoption of PPIs aimed at facilitating Universal service. It also raises discussions in this area of research as well as practical implications. This calls for more research. However, the research based on the research on real life cases, has proven that such a PPI is possible. The financial and organizational arrangements have been identified. The results also prove that the arrangement can possibly be utilized in Ghana and Nigeria.

12.2 CONTRIBUTION TO LITERATURE

The findings in this research point to the fact that it is possible for bottom-up initiatives aimed at Broadband infrastructure delivery to be facilitated in rural areas globally. It also points to the fact that bottom-up initiatives in very poor rural areas in developing countries are possible. This is because this report does not only propose PPI models, but it proposes frameworks that can be used to mobilize people to implement the infrastructure I collaboration with the public and possibly the private sector. The research also documents cases of people in different rural and semi-urban areas around the world where bottom up initiatives were facilitated. This report contributes to literature by agreeing, disagreeing and extending the findings of selected research discussing the facilitating of the bottom up approaches as well as research on the adoption of PPI to facilitate Broadband infrastructure. The selection was random and driven by identifying literatures that represented school of thoughts on the issue.

12.2.1 POINT OF AGREEMENT WITH LITERATURE ON BOTTOM-UP APPRAOCHES

The points of agreement between this report and literature were on the fact that:

Bottom-up projects are localized: Bottom-up projects are localized, investments are long term, it is easier to aggregate and maximize demand and public funding may be needed to facilitate bottom-up approaches to supplement coop funding in rural areas (Yardley, 2012).

The hybrid approach can facilitate rural Broadband connectivity: A blend of the top-down and the bottom-up approaches can positively facilitate the delivery of Broadband Internet infrastructure in rural areas (Salemink & Bosworth, 2014)

Demand driven Broadband infrastructure and service delivery is possible: The interaction between technology driven infrastructure delivery and demand/service driven principle for Broadband infrastructure development is important (Lindskog & Johansson, 2005). In this research, demand and service driven principle is viewed from the perspective of the people (Non-profit private sector). This report does not "demonize" top-down PPI approaches. However, the emphasis here is for the people to facilitate the infrastructure development. They have to know what the technology is about, the type of services it can produce and what they can use it for. Hence the technology does not have to be a luxury, but a necessity from the people's point of view. Lindskog and Johansson's idea of facilitating demand was from the municipality's point of view. Hence this report agrees with the principle of demand/service driven development.

Policies that facilitates bottom-up approaches are necessary: There ought to be policies aimed at facilitating rural dwellers to own, control and manage their Broadband networks (Kakekaspan, O'Donnell, Beaton, Walmark, & Gibson, 2014).

12.2.2 POINT OF DISAGREEMENT WITH LITERATURE ON BOTTOM-UP APPROACHES

The points of disagreement between this report and some literature were as follows:

Coop expertise to facilitate Broadband networks: Yardly (2012) argues that coops lack the expertise to facilitate telecom networks. The primary cases studied have debunked this idea. Although one would say that Yardly's point can be correct if one is considering huge the deployment of complex networks. However, once the network deployed is not complex, the co-ops have proven to learn on the job. The reason for this report suggesting a private sector management is because in many cases, the sustained management interest may not be there unless there are some incentives for the coop managers.

The lack of financial capacity in rural areas to facilitate Broadband networks: Yardly (2012) also points to the fact that underserved communities in emerging markets may not be able to finance such project. This has also been proven otherwise with the Ghana Wireless project. Although the level of subscription was low, the interest of the village in managing the network indicates the fact that people could manage the network, once they see the usefulness of the network to them.

The idea of Hybrid Public Broadband: Tapia, Powell & Ortiz (2009) proposition of a municipality-community hybrid ownership (Hybrid public Broadband) is not supported by this report. This report opts for community ownership. The Municipality mediated model proposed in this report does not grant infrastructure ownership to the municipality but to the people. From Tapia, Powell & Ortiz Point of view the municipality can fulfil their interest in promoting democracy (civil engagement), social inclusion and economic development (Tapia, Powell, & Ortiz, 2009). The community's interest is to promote civic engagement and cultural capital (Tapia, Powell, & Ortiz, 2009). Although this is true in the American case, which was their context of study, the coops studies in this report did were not interested in civic engagement but on how the technology will fit into their already existing lives. An example is the use of Skype, a VoIP. This was used because the cost of calling a friend with Skype was free compared to mobile telephony. Hence the Broadband Internet provided a substitute to traditional voice calls. In the Ghana Wireless Project, the customers were more interested in an alternative means of entertainment like YouTube. This was a substitute to the limited TV channels they watched and they had the choice of entertainment. However, this is not in line with municipality aims and objectives. Hence this report posits that people owned infrastructure gives the people the feeling that they own the infrastructure. Hence the Public sector, be it municipality or otherwise, should only facilitate the delivery of the community or people's infrastructure. It is when the infrastructure exists, that the municipality can decide to provide schemes and applications that will foster its objectives.

The inability for communities to facilitate Broadband networks without public financing: Another point of disagreement between this report and existing literature is that community-led initiatives cannot occur on their own without some external help (Salemink & Bosworth, 2014). The case of Djurslandsnet, Magnolia Road Internet Coop and JAWUG, South Africa are testaments to the fact that people can organize themselves without public help.

The rebuttals to some literature findings were the surprise findings of this report. The line of reasoning at the start of this research was in line with parts of literature whose arguments are refuted by the findings of this report. These surprise findings did provide a strong basis for proposing people - own networks. One would say that rural dwellers have been judged from an external point of view. However an in-depth study of their nature proves that once they have the sense of ownership and they can attribute the usefulness of the technology to their daily lives, then they are willing to pay more to develop the network and adopt the service. The rational question is what is their source of income? But in this research, it was clear that low income was not a barrier once the financial arrangement of the business model was spread in such a way that the rural dweller could pay without feeling it. This is where; especially in rural areas of sub-Saharan Africa, the village governance structure should be of use.

12.2.3 EXTENSION OF LITERATURE ON BOTTOM-UP APPROACHES

The ideas of this research are similar to Kakekaspan et al (2014) and Salemink & Bosworth (2014). The points of agreement and the points of disagreement can be seen in the previous headings. Salemink & Bosworth (2014) view the solution to rural Broadband connectivity from the practical implementation point of view. The work of Salemink & Bosworth (2014) can be surmised by the fact that the blended approach, a mixture of the top-down, bottom-up approach is the best way rural Broadband infrastructure can be facilitated. However, they warn that a good business case will attract public attention and public subsidy. Just like this report, they base their findings on coops. The difference was that the coops studied were in the UK and the Netherlands. Kakekaspan et al (2014) views the solution to facilitating bottom-up initiatives from a regulatory point of view. Here they argue that the first mile regulatory approach - which argues for community management and control of Broadband infrastructure - is the best solution to facilitate rural Broadband connectivity. They argue that in this manner, the communities can maximize the benefits of the Broadband network and the infrastructure in their own way. Their case study was the community Broadband networks at the Indian reservation in Canada - Fort Severn First nation.

This report, despite its disagreement with few ideas in the report, shares similar sentiments. However, it provokes discussion in the area by providing a framework by which business cases can be built and also attempts to develop models that would facilitate demand where demand does not exist. Based on the models developed, first mile regulatory frameworks can be built around it and tried out. Hence this report extends existing knowledge in these areas, provokes academic discussion as well as build on this existing ideas by extending it. One would say that this report is a go between the literary schools of thoughts represented by the two literatures.

12.2.4 CONTRIBUTION TO LITERATURE DISCUSSIONS ON THE ADOPTION OF PPI

The only similarity in the discussion towards PPI in this report, to existing Broadband infrastructure literature, is the analysis of national PPI investment patterns. Normally issues bothering on the bottom-up approach are rarely called PPIs. Few literatures identify the provision of public subsidy to coops as PPIs (see (Yardley, 2012)). In chapter 3 of this report, it is clear that PPIs do involve the relationships between the municipality or any public agency with the old telephony coops and now Broadband co-ops. However, this fact provokes academic conversations and also contribute to support the school of thought of Yardly (2012) and Siochru & Girard (2005). Current discussion on PPIs in the provision of Broadband infrastructure as seen in this report is often discussed at the Macro level and sometimes at the Meso-level where it involves a municipality led initiatives. However, the ultimate PPI proposals are actually aimed at the micro-level of infrastructure development. It is a purposeful framework for rural areas. This does not imply that it cannot be used in urban areas. Hence, from this angle, one can say that the report contributes to the on-going discussion on PPIs aimed at facilitating infrastructure development.

12.3 THEORETICAL RELFECTIONS

Two theoretical approaches- Stakeholder Theory and Actor Network Theory- were utilized in this report. The third approach - Grounded Theory - was an inductive way of generating a hypothesis to explain the phenomena studied.

The adoption of Stakeholder Theory was problematic for this study as Stakeholder Theory is a highly descriptive theory. As mentioned in the report, some school of thought believes that Stakeholder Theory is not a theory, as it lacks universal constructs. This report differs from the assertion of Stakeholder Theory not being a theory; rather the report upholds that it is a flexible theory. Stakeholder description could be normative, instrumental or descriptive.

In this report, Stakeholder Theory revealed the norms that provided the underlying philosophy guiding the coops. Based on these norms, some intrinsic laws guiding the relationship between the Universality funds and the stakeholders in Ghana and Nigeria were interpreted. Aside empirical data gathered from these agencies, the various regulations backing the cooperation were used to identify the underlying rules. Still on the exogenous relationship between the universality funds and their stakeholders, the connections between them were examined, implying the use of the instrumental approach of stakeholder theory. The Stakeholder theory approach by Mitchell et al (1997) provided a roadmap for examination. Finally, how these stakeholders relate to the universality funds were also described.

Hence, one would say that, although there was no universal framework for analysis, limited analytical hermeneutical flexibility exists with Stakeholder Theory. However, as mentioned earlier, this lack of a unified framework analysis provided some hermeneutical difficulty in interpreting text and speech from the data. However, it does not mean it is not a theory as one can use it to gain understanding of the workings of a corporation or an organization. As Key (1999) puts it, a theory should provide a roadmap to explaining reality. One would not see stakeholder theory as a one way GPS navigator towards reality, rather one can see Stakeholder Theory as a multiple option GPS navigator directed by the person searching for direction.

Actor Network Theory, on the other hand provided an ideological approach towards understanding phenomena or an event. Unlike the Stakeholder Theory, the ANT provided an opportunity to retrace the origins of the organization, identify the actors as well as identify with the emotions of the Actor and the resulting consequences. An example is the case of DjurslandsNet, where the initiators led by the frustration of not being able to facilitate the involvement of the Danish Private Sector decided to facilitate the infrastructure by themselves. By implication, the interactions between material and semiotics (human and non-human actors (emotions)) were important for this report, because one could get into the minds of the human actors. However, non-human actors were also important because in the Swedish case, - understanding that the storm of 2005 which destroyed the telephone lines in some Parishes in Almhult could reoccur - called for a rethink in choosing a Broadband infrastructure that will be storm proof.

However, ANT is also without a universal construct and highly hermeneutical in its utilization. Different researchers can research into the same phenomena, identify the same Actors but emerge with different forms of interaction. An example is Michael Callon’s work on the Domestication of Scallops at the St Brieuc Bay mentioned in chapter 5. In reading the paper, one wonders why the water was not an Actor in the analysis, if in ANT every actant is important. This implies that an actor network is researcher dependent and in most cases does not necessarily involve all the actors – even punctualized actors. In the research, the Actor Network became problematic when it was time to identify causal factors for the phenomena. This exercise became a highly subjective exercise; hence the ANT could not be used to validate the Grounded Theory output. The ANT is very useful for analyzing the network of Actor interactions, but very weak when it comes to identifying causal factors of those interactions. The causal factors observed will be highly subjective to each researcher. However, in this report, it was very helpful in not just tracing the evolution of the co-ops but in identifying how they were organized. Michael Callon's framework identified in his aforementioned work was helpful in the process. The argument this report makes for ANT being a theory is not different from the argument made for Stakeholder Theory. The ANT is also a descriptive theory.

The use of Grounded Theory produced unexpected theoretical insight to the report. The line of argument for this report was centered on PPIs. Hence theories that denoted partnerships and stakeholders were used. However, from the theoretical point of view, the main hypothesis –the combination of the developed and developing country model- provided some other theoretical insights. These were diffusion, adoption and implementation theories. The implementation model for rural Broadband adoption, which is the main hypothetical product of the Grounded Theory exercise, shows the path for the diffusion of innovation within the context of coops adopting rural Broadband. The similarity this model bears with the diffusion of innovation model of Rogers (1962) is that there is a channel of communication via a social system. However the difference lies in the fact; in the Rogers model, knowledge of the innovation and persuasion of the innovation will lead to the decision to implement. However, in the implementation model for rural Broadband adoption, the usefulness variables and the possession of vital resources was enough for the people to decide on whether to adopt the innovation or not. The second aspect of this difference was the fact that Actual usefulness in some cases denoted scarcity. These were some of the differences between the two theories. They do not complement each other as the contexts are different. Adoption theories such as Technology Acceptance Model, the Universal Theory for Acceptance and Use of Technology are examples of other adoption theories. However the proposed model here neither supports nor validates them, but provides an adoption and diffusion model for another context.

However the Grounded Theory has proven to be a tool for developing hypothetical relationships. Although the end product of Grounded Theory analyses were subjective hypotheses or theories, one would say that the level of subjectivity is reduced by the rigors of coding and creating relationships within the categories. This is rigorous and time consuming. The impact Grounded Theory had in this research from a reflection point of view began with the fact that aside, the ANT structured ideas, it was important to allow the interviewees room to go into detail description which led to follow-up questions. The first interview with DjurslandsNet was lengthy as a result of this factor. Hence reflection and coding of the questions led to the development of comparative questions in subsequent interviews. This iteration went on and to supplement the questions, external documents were granted by the interviewers for the purpose of this research. In this research, reflection was important. This involved within-case reflection and cross-case reflections. Here subjectivity played a role as one had to consider if an action in one country could be interpreted as a similar action in another country. In some cases, the answers had to be found in discussion with friends and acquaintances from other cultures. Although Grounded Theory is aimed at developing theory or hypothesis from an inductive point of view, the great significance of Grounded Theory was that, it provided a rigorous way of identifying the causal factors in the case and cross-case analysis. The disadvantage with Grounded Theory from the perspective of this report would be in the naming of codes and categories. The naming of codes is subjective, not only to the existing formal knowledge reservoir of the researcher, social experience, practical experience with the phenomena but also subject to feeling. In the process of coding, there is an unconscious embedding of oneself in the identified processes, actions and interactions. At that moment one could see a concept of a category differently one day and differently the next day. Hence, although Grounded Theory for qualitative data can be thought through quantitatively, no matter the sample size, there has to be a statistical qualitative test to validate the theory.

From a theoretical standpoint, this research offers room for reflection on what should be classified as a theory, what role do descriptive theories play in research and what more should be done to continue the process of standardizing a Grounded Theory. Finally, the theoretical discussion provides a framework for discussion on implementation of Broadband in rural areas.

12.4 IMPLICATION FOR PRACTICE

In the first chapter of this report, an effort was made to explain the Broadband Access Gaps, globally as well as in developed and developing countries. Fixed and wireless Broadband Internet infrastructure penetration in the developed world was much higher than that of the developing world. In sub-Saharan Africa, the Broadband Access gap is larger for fixed than mobile Broadband infrastructure. The usage of Broadband Internet service is also low in the region. However the good news for sub-Saharan Africa and in most developing countries is that they have invested heavily in the facilitation of Broadband backhaul via fiber optics. This report indicates that the universality funds in Ghana and Nigeria are very much involved in extending backhaul connectivity into rural areas wirelessly and via fiber optics respectively. Hence, the proposed PPIs in this report are mechanisms that can be used to fill patches. The patches in this case are true access gaps. This implies that in some cases, the localized infrastructure may be small. It also implies that private sector involvement (if needed) would not require an infrastructure spread over a large area, rather patches of localized infrastructure in different locations. However, in rural areas in sub-Saharan Africa, the patches may be larger.

The implication of the proposed PPI arrangement and the Municipality Mediated Model would require regulatory and legal frameworks, mobilization of the people and the actual implementation process. In this report, the universality fund is regarded as the arrowhead of the project. This is how it should be in countries with active and financially buoyant universality funds. However, in countries with universality funds that are not well funded, then if national laws permit, they can partner with the municipality, the relevant sector ministry or an independent special public agency can be created to act on behalf of the public sector.

In drafting the regulations, it would be more efficient if the regulation and the legal framework are strictly for rural Broadband facilitation. This is important because each country should be able to spell out how the partnership will be arranged, how the role of people serving as owners of the network will be protected, how the role of the private sector should not present threats of sabotage to the network. It is also important to identify funding sources. The funding source will vary from country to country. The funds could be direct from the national budget for rich nations. It could be also be from some sort of taxation, cross-sector, cross-subsidization etc. On the part of the people, although they are to provide a certain amount of funding, there should be a model that spell out financing responsibilities. This model should encourage long term strategies of raising the money. The public sector in very poor, countries can decide to supply an upfront loan while they monitor the repayment. The coop repayment plan in this case should have a time frame. Another option is to devise a model where the connection is made in phases. The first phase would be for those who need such connectivity, the second phase for those who need later connectivity, etc. Another way is for the public sector to set aside the percentage coops or other social will have to pay for the implementation.

However, what would play an important role would be the public sector, facilitating the coops or working in conjunction with village councils in the case of sub-Saharan Africa. This is where the relevant coop facilitation models come into play. In mobilizing the public sector, in developing countries, it is important to mobilize very small telecom infrastructure providers. The telecom network operators are capable of managing the process, but the revenue from these rural operations will be insignificant to them. Hence, small ISPs and Broadband Infrastructure providers, searching for markets to operate are the best bet. In developed countries, any Broadband infrastructure and service provider can deploy. This is because the people may be able to afford the service as seen in the case of Almhult municipality.

The actual implementation process should be decided by the people. The regulatory framework should give them that the right to do so.

12.5 LIMITATIONS

The limitations of this research were as follows:

Few number of cases: The numbers of cases in the primary cases were few. This was because these were the only rural Broadband coops that responded to the invitation to be interviewed.

The need for statistical validation of the implementation models: The overall framework, the implementation model for rural Broadband adoption needs to be statistically validated with a large sample size of data from other research or validated statistically.

Limitation posed by travel distance to some of the cases: There was the limitation of distance; cases within proximity were face to face interviews. However, there were cases, in which there was no resource to get there, hence the contact was via Skype.

The PPI Models were not tested in the secondary cases: The believed that the cases will work in Nigeria and Ghana is theoretical and based on the fact that the respondents at the universality funds thought the idea sounded interesting. It will be necessary to actually test the PPI frameworks in a rural area in those countries.

Limitation of producing a universal PPI Framework: The proposed PPI frameworks, lack deep details aside the organization and financing of the frameworks. This is because it is difficult to develop a universal framework that would work in every country, hence it was important that the frame worked developed serve as a foundation where different countries can decide on how to facilitate it.

Greater emphasis is placed on Broadband connectivity than on Broadband service delivery: The focus of the research is on connectivity, the kinds of services are not addressed.

CHAPTER 13. CONCLUSION

13.0 INTRODUCTION

In this section, contributions made by this research, the summary of each chapter, the conclusions on the findings of the research and the prospect for future works are highlighted.

13.1 OVERVIEW OF THE RESEARCH

The central tenet of this report has been that Universal Access and Service of Broadband internet infrastructure in rural areas is possible if facilitated via Public Private Interplays. The adoption of Public Private Interplay has been viewed in this report as a supplementary initiative to the current practice of Broadband infrastructure development via market facilitation. This supplementary approach was deemed necessary as it has been stated earlier in this report that the Broadband market players do not find rural areas, commercially viable to deploy their infrastructure and services. This commercial unviability of rural areas – as identified in this report- is as a result of the presence of low commercial activity in rural areas, low population density; in some cases people in rural areas are low income earners. Based on these factors, among others, Broadband infrastructure providers are reluctant to invest in these areas as they are not guaranteed Return on Investment (ROI). In proposing a solution to this problem, the PPI discussion in this report contributes to the discussion on how the public and private sector could collaborate to reduce the Capital Expenditure (CAPEX) needed to facilitate Broadband Internet in rural areas. The point of departure lies in the involvement of the non-profit private sector as well as advocating for infrastructure ownership to be with them (Non-profit private sector).

Researching into the problem statement of this research, the research questions hovered around how these PPIs can be facilitated in rural areas. Here the rural areas in consideration related to rural areas in developing countries. The sub-region in focus was sub-Saharan Africa and the case countries were Nigeria and Ghana. In searching for the answer to the research questions, inspiration had to be drawn from rural areas around the globe where Broadband infrastructure development occurred via PPIs facilitated via bottom-up approaches. These bottom-up PPIs were non-complex initiatives that could be replicated by the Universality funds in Nigeria and Ghana (the secondary cases). The non-complex nature should provide room for adjustments that would fit into the existing regulatory framework, and relevant market that exists in both countries. The following bottom-up initiatives served as the primary cases for inspiration to solving the problem. These cases were the Djurslandsnet in Denmark, Magnolia Road Internet Coop, Colorado, USA, Airjaldi

(Dharamsala Wireless network) in India, The Almhult Municipality Broadband initiative in Sweden, The Johannesburg Wireless User Group in South Africa and the Ghana Wireless User Group. Other cases that were identified, but there was no sufficient information about these cases to analyze them. However, they are worth mentioning. These were the OnsNet Nuenen (Netherlands, mentioned in the literature review); Macha Works in Zambia and the community - based network in Tanzania. The UK Broadband Coop, though not mentioned in this report was also sighted.

However, using the ANT to investigate the primary cases, the relevant actors and the organizational and financial arrangement of the primary-cases were identified. Using the Grounded Theory, models depicting the implementation processes of the each of the primary cases were identified. The emerging models resulting from the Grounded Theory analysis were: the developing country model, the developed country, model and the public sector model. These models showcased the causal factors for implementation and the actions and interactions that took place. These findings provided a tool or roadmap that can be used to mobilize people in rural areas of developing and developed countries to facilitate Broadband coops.

The ANT results and the Grounded Theory results produced a reservoir of stakeholders, actions and development contexts. The Stakeholder Theory was adopted to identify the relevant stakeholder in the Universal Access and Service ecosystems of Nigeria and Ghana. The PPI projects were identified and the role of the stakeholders in the PPIs was identified. The relevant communication laws were used to validate each stakeholder. Based on the result of this process, the identified stakeholders in the primary case studies were juxtaposed with those from the secondary case studies - Nigeria and Ghana. The reflections on this process led to the identification of plausible possibilities for organizing and financing arrangements aimed at the implementation of Broadband Internet infrastructure in rural areas of Ghana and Nigeria. Based on data gathered and inspiration from the primary cases, two possibilities for facilitating the PPI in these countries were identified. These were a PPP arrangement and the municipality mediated model. At this point, the research question for this report was answered. However, due to the generic nature of the PPI models, it was evident that these models can be adopted in rural areas globally. The country adopting the model had the option to decide who the stakeholders in each black box would be. This outcome, provided a global implication for the models.

13.2 CONTRIBUTIONS OF THE REPORT

This contribution of this research can be seen in three areas. The three areas where possible contributions exist are in literature, theory and practice. The contributions are not grand, but rather minor. In some cases, the contributions rather strengthen existing insights into the issues discussed.

Contribution to Literature: At the inception of the investigation recorded in this report, the primary idea was to contribute to the on-going discussion on facilitating Broadband Internet infrastructure using PPIs. The major idea was to analyze what was going on in the area and report the trends. In the second, third and fourth chapters of this report, an attempt was made to identify the trends towards PPI using historical time lines. In this report, PPI was stretched beyond the contemporary idea of public - private mix to include any form of relationship that involved the public and private sector aimed at developing telecom infrastructure. Based on this line of thought both in definition and in literature, as well as the usage of the historical timeline, this report has identified PPI as an evolving concept. The report identifies and agrees with the fact that PPI was a concept without boundaries as well as a concept shaped by emerging trends in the facilitation of telecommunication infrastructure.

In this report the discussion also contributed to the on-going discussion on Universal Service. This was because there are debates on whether the “affordability, accessibility and availability,” definition was still relevant. The crux of the argument has been that the transmission and delivery of IP - based networks differed from the delivery of Plain Old Telephony Service (POTS). The POTS required one telephone to one household. This was in most cases the circuit switched transmission. The emergence of package switched Mobile telephone networks changed the dynamics where telephony penetration was viewed from the lens of one man one mobile phone. It is important to note that most mobile networks in certain countries are still circuit switched. However, today with Broadband infrastructure, converged telephony, broadcast and electronic communication services are multiplexed to access points or individual homes. This raises the question of how do we then define universal Service or Universal service of what? Which Broadband Service do we consider as a basic service and which one is a luxury service? Hence the availability of what service, the affordability of what service and the accessibility to which service? However, this is not much of a problem when it comes to the Universal Access to Broadband infrastructure as different countries determine the Broadband infrastructure that is of importance to them. The conclusion here was that the discussion of availability, affordability and accessibility towards attaining Universal Access and Service of Broadband networks and services is still valid.

However, in this report, an attempt has been made to highlight the evolving definitions of Universal Access and Universal Service using historical timelines. The historical timeline span from the telegraph days till date. One could see that the prevalent technology, the nature of the technology as well as the different perceptions of the Public and Private sectors to the technology did influence how Universal Access and Universal Service were perceived. It was also discussed that Universal service is also viewed differently by different countries. The contribution of this report to the discussion on Universal Access and Universal Service is that

Universal Service did mean different things at different times depending on the public need, technological changes and the desires of the market. The conclusion was that this evolution on the concept of Universal Access and Service will be an on-going discussion and in the nearest future, Universal Service will still be on connectivity maybe not of the service but household access to the infrastructure.

Contribution to Theory: The findings in this report do not extend the theories utilized in this report. Rather, it critiques the theories. It does validate the applicability of the Stakeholder Theory in the secondary case study. This is because the Stakeholder Theory did help in understanding the power relationships between the stakeholders in each of the cases. The Actor Network Theory was a weak analytical tool. The weakness of the theory laid in the over reliance on subjectivity leading the presentation of the world based on how the researcher sees it-hence a private truth. It did not provide room for rigor. However, if this study was aimed at documenting how the cases emerged and to further analyze the emergence process, ANT would have been a strong tool. However, the ANT gave room for gathering much information about the cases. The ANT also provided enough information to understand how the cases were organized and financed.

The contribution to theory in this report stems from the emerging models. These are “working theories” or substantive theories, rather than formal theories. The report presents two main theoretical PPI models. The models present an outlook to possible PPI relationships in facilitating bottom-up Broadband infrastructure. These models can be regarded as formal PPI models, once it has been tested on a case and it works. The two implementation models or hypothesis extracted from the Grounded Theory analysis are not formal theories yet. They have to be tested and validated to become a formal theory. Both hypothetical models support the diffusion of Innovation Theories as well as adoption theories as they present how an innovation can be adopted by people in rural areas in developed and developing countries. If the sample interviews conducted were gathered from more than a hundred sources and these hypotheses were developed, then one would stand firm to say that these models are formal theories. One would vouch for the quantitative validity of these models as theories. However, these models or hypothetical relationships are contributions that call for more research. However, the models are novel. The caveat here is that the research is not a Diffusion of Innovation, research. One would call the model outcomes, a surprise outcome.

Contribution to Practice: The PPP arrangement model and the Municipality Mediated Models are Broadband infrastructure facilitation models that are novel to sub-Saharan Africa. However, they were designed in a way that these models rest on existing market and stakeholder structures in Ghana and Nigeria. These models can also be of use not only in rural areas in sub-Saharan Africa, but also in developed and developing countries. This is so because the proposed PPP model arrangements are flexible. The only non-flexible section is the non-acceptance of direct private funding and people owned infrastructure. One would say that the primary-cases studies were dismantled and reassembled to create these frameworks. The findings also proved that there is a possibility of this model being adopted. The only disadvantage of this model may arise when the actual costing implications come into play if not well managed.

13.3 CHAPTER SUMMARIES

Chapter 1: In chapter 1, the summary was that Broadband Internet infrastructure and Service in rural areas was low. Developing countries suffered the most and sub-Saharan Africa suffered the most.

Chapter 2: In chapter 2, the summary was that Universal Service is an evolving concept. It will continue to change as Next Generation technology, transport and delivery changes.

Chapter 3: In chapter 3, the summary was that PPI is a broad concept whose boundaries include any public or private collaboration. In this context, the collaboration is aimed at developing Broadband internet infrastructure. The chapter also indicated that PPI is a tool that can lead to achieving Universal Access and Service as the public private synergy can aid in facilitating rural Broadband connectivity.

Chapter 4: In Chapter 4, emphasis was placed on a form of PPI that has been used in recent times to facilitate telecom infrastructure delivery. This is Public Private Partnerships (PPP). The summary of the chapter was that PPPs in recent times has been the driver toward high cost Broadband Infrastructure development.

Chapter 5: Chapter 5, explained the theories used in this report. This is the Stakeholder Theory, the Actor Network Theory and the Grounded Theory. The chapter explained how these tools relate and how they were deployed in the report.

Chapter 6: Chapter 6 outlines the methods used in facilitating the research

Chapter 7: Chapter 7 is the first set of findings of this report. Here the site visits, network maps and literature documents are used to prove that the problem of low Broadband penetration exists

Chapter 8: Chapter 8 is the first report and analysis. The findings indicated that PPIs in rural areas was possible. It also showed that the people can lead the way to organize themselves and raise finance to fund both fixed and wirelesses Broadband

Infrastructure. The Ghanaian case solidified the belief that people in rural areas can mobilize themselves.

Chapter 9: Chapter 9 is the second report and analysis. The summary of the results using the Stakeholder Theory was that Nigeria and Ghana were already used to PPPs and were open to bottom-up approaches towards facilitating Broadband Internet Infrastructure.

Chapter 10: Chapter 10 was the Grounded Theory analysis. The summary of the chapter was the findings that people in rural areas will organize and develop Broadband infrastructure if they can see the usefulness of the technology and the service, they have the vital resources to facilitate the service and they know why they need the service (actual usefulness). In the developed countries, the findings were that people in that part of the world will deploy Broadband infrastructure if see the technology to be useful, they have the vital resources and can identify deployment possibilities.

Chapter 11: Chapter 11 is a synthesis of the findings aimed at identifying how the PPI in Nigeria and Ghana can be facilitated. The summary of the extraction was the proposal of the PPP arrangement and Municipality Mediated Model.

Chapter 12: Chapter 12 is the discussion chapter

Chapter 13: Chapter 13 is the conclusions

13.4 CONCLUSION ON FINDINGS

The conclusion on the findings is as follows:

It is possible to facilitate bottom-up PPIs: There is a possibility that with the PPP/PPI arrangement and the Municipality Mediated Model, bottom-up initiatives can be facilitated to develop Broadband internet infrastructure in rural areas of Nigeria, Ghana, sub-Saharan Africa, developing and developed countries. The reason for the confidence lies in the flexibility of the model.

Understanding the need of users is vital: In rural areas where there is a need, the developed and developing country models are possible tools that can be used to mobilize the people. The grand model can also be used as well. However, as mentioned earlier, these models are hypothesis and not fool proof theories.

It is important to identify the unique vital resources in a community: This particular finding requires attention. When mobilizing people it is important to identify their unique vital resource(s) and not rely on conventional infrastructure development trends. The potential in rural people is much greater than what is usually envisaged. In many cases, the fact that retirees, graduates who could not make it in the city and uneducated people fascinated by technology should be the first port of call. In these individuals lie potentials, that are dormant. These individuals should in many cases be the first set of people one should identify in rural areas. This is because their previous knowledge and inner desire to enjoy city amenity in the village is important. They will be willing to use what they have to produce hat they want.

Risk assessment by the public sector is vital when designing the PPP framework: PPIs if applied with minimal risk factor and reasonable affordability calculations can facilitate rural Broadband infrastructure. This is possible with wireless infrastructure like Wi-Fi in very poor rural areas and with fixed-Broadband infrastructure in developed countries.

The network should be owned by the people: The major finding of this report, aside the findings related to the research questions, is that People owned Broadband Internet Infrastructure is possible

13.5 FUTURE WORKS

This research has thrown open a door to lots of possibilities that require more investigation. The scope of investigation is huge, however, they can be broken down into a few headings. The future work includes:

Validation of models: Quantitative validation of the implementation models identified in this report is necessary. This will require taking a sizable number of rural areas through an action research process to see if the people will deploy, if all the causal factors or independent variables are satisfied.

The Impact of telecentres in rural areas: The next step would be to investigate the impact of previous and current telecenter initiatives to understand the level at which the user finds Broadband services useful and in what way it will be useful to them. Testing the adoption of a VoIP service against the mobile Networks Voice service could be an opening. If the people find VoIP and cheaper than their current voice solution, they may see an actual usefulness or Broadband Internet infrastructure.

Field test of PPI Model: It will also be important to understudy a community, deploying such a service, either in a developed or developing country, to understand if they follow the same implementation pattern or there are contextual changes.

The Standard adoption pattern for the PPI Model: The PPP arrangement and the Municipality Mediated Models are flexible propositions or inspirations. It would be important to identify how this model is adopted and what the standard approach for adoption should be.

These are but a few outlines of future works related to this research.

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APPENDICES

Appendix A. Demographic overview of the cases

This section presents a demographic overview of the primary cases.

Appendix A.1 Demographic Overview for Developed Countries

This section presents a demographic overview of the locality where the developed country primary cases are domiciled. Appendix A.1.1 presents the demographic overview of Djursland, where Djurlandsnet is domiciled. Appendix A.1.2 presents the demographic overview of Nederland, Colorado, where Magnolia road is located. Appendix A.1.3 presents the demographic overview of Hallaryd, Sweden. This is where the Hallaryd Broadband Coop is located. Appendix A.1.4 presents the demographic overview of Almhult, the municipality where the Hallaryd Broadband coop is located. It was also necessary to understand the demography of the municipality as well, as the Almhult Broadband Initiative was for the whole municipality.

Appendix A.1.1 Demographic Overview of Djursland

This section consists of tables with demographic data about Djursland gathered from Statistic Denmark. In some cases, current data was that of 2011.

Population of Djursland

Municipality (Kommune)		Male	Female	Total
Norddjurs	Population	19271	18715	37986
	Household			17954
	Rural Population			9986
Syddjurs	Population	20952	20767	41719
	Household			18581
	Rural Population			126671

Source (Statistic Denmark) Source: Norddjurs**Error! Bookmark not defined.**, Syddjurs**Error! Bookmark not defined.** *Second quarter of 2013, **

Population Spread

Municipality		Age group (years)	Population	Aggregate Population
Norddjurs				
	Children	0 - 10	4115	4115
	Adolescent/ Teenage Population	11 - 20	5090	5090
	Youth/ Young Adult Population	21 - 30	3408	7327
		31 - 40	3919	
	Middle Age Population	41 - 50	5540	11162
		51 - 60	5622	
	Elderly Population	61 - 70	5410	10286
		71 - 80	3115	
		81 – 90	1454	
		91 - 100	300	
		101 - 104	7	
Syddjurs				
	Children	0 - 10	5071	5071
	Adolescent/ Teenage Population	11 - 20	5497	5497

	Youth/ Young Adult Population	21 - 30	2712	7460
		31 - 40	4748	
	Middle Age Population	41 - 50	6282	12300
		51 - 60	6018	
	Elderly Population	61 - 70	6313	11391
		71 - 80	3450	
		81 - 90	1370	
		91 - 102	258	

Source (Statistic Denmark)

Employment Status

Municipality	Employment Status	Population
Norddjurs		
	Some form of employment/income	34371
	*Self-Employed	1718
	*Assisting Spouse	78
	*Top managers	493
	*Upper level employees	2352
	*Medium level employees	1304
	*Basic level employees	8217
	*Other employees	1789

	*Employees not specified	1591
	*Unemployed	757
	*Temporary out of labor force	858
	*Retired from the labor force	965
	*Pensioners	8540
	*Others outside the labor force	9245
	Registered Unemployed	856
	Retired	2759
Syddjurs		
	Some form of employment/income	38152
	Registered Unemployed	821
	Retired	2746

source (Statistic Denmark) *2012 data

Workplaces by region, industry and time (Nord Djurs)

	2011
Norddjurs	
A Agriculture, forestry and fishing	507
B Mining and quarrying	6
C Manufacturing	149
D Electricity, gas, steam and air conditioning supply	25

E Water supply, sewerage and waste management	22
F Construction	215
G Wholesale and retail trade	333
H Transportation	94
I Accommodation and food service activities	105
J Information and communication	53
K Financial and insurance	29
L Real estate activities	105
M Knowledge-based services	109
N Travel agent, cleaning, and other operational services	65
O Public administration, defence and compulsory social security	12
P Education	66
Q Human health and social word	177
R Arts, entertainment and recreation activities	36
S Other service activities etc.	109
X Activity not stated	0

From 2008 a new data source for establishment-related employment statistics (ERE statistics) are used. As a consequence there is a databreak in the statistics.

Source (Statistic Denmark)

Workplaces by region, industry and time (Syd Djurs)

	2011
Syddjurs	
A Agriculture, forestry and fishing	449
B Mining and quarrying	5
C Manufacturing	149
D Electricity, gas, steam and air conditioning supply	18
E Water supply, sewerage and waste management	28
F Construction	317
G Wholesale and retail trade	391
H Transportation	107
I Accommodation and food service activities	127
J Information and communication	57
K Financial and insurance	36
L Real estate activities	130
M Knowledge-based services	197
N Travel agent, cleaning, and other operationel services	105
O Public administration, defence and compulsory social security	13
P Education	69

Q Human health and social word	191
R Arts, entertainment and recreation activities	49
S Other service activities etc.	98
X Activity not stated	1

From 2008 a new data source for establishment-related employment statistics (ERE statistics) are used. As a consequence there is a databreak in the statistics.

Source (Statistic Denmark)

Average Income of citizens of Nord Djurs

Disposable income by sex, region, unit, income interval, age and time for NordDjurs

2011		
Men and women, total		
Norddjurs		
Average income for persons in the group	DKK	US $
All		
15-19 years	33 424	5837.62
20-24 years	112 507	19649.93
25-29 years	170 558	29794.84
30-34 years	204 445	35718.57
35-39 years	216 114	37753.20
40-44 years	227 561	39744.06

45-49 years	236 895	41364.46
50-54 years	222 258	38806.53
55-59 years	224 408	39184.46
60-64 years	198 154	34605.08
65-69 years	167 954	29334.01
70-74 years	161 740	28248.70
More than 74 years	147 01	2568.53

Sources: Statistic Denmark; US Dollar Rates retrieved from www.XE.com on the 2nd July, 2013

Average Income of citizens of SydDjurs

Disposable income by sex, region, unit, income interval, age and time in Danish Krone (DKK) for SydDjurs		
	2011	
Men and women, total		
Syddjurs		
Average income for persons in the group		
All	DKK	US $
15-19 years	30 524	5308.31
20-24 years	106 665	18548.48
25-29 years	169 789	29537.65
30-34 years	211 003	36694.73
35-39 years	237 240	41258.75

40-44 years	249 529	43397.46
45-49 years	241 564	42013.71
50-54 years	250 059	43492.90
55-59 years	239 581	41674.09
60-64 years	221 711	38566.84
65-69 years	189 778	33015.70
70-74 years	164 734	28660.00
More than 74 years	158 855	27636.94

Sources: Statistic Denmark; US Dollar Rates retrieved from www.XE.com on the 2nd July, 2013

Appendix A 1.2 Demographic overview of Magnolia Road Internet Coop

Magnolia Road is located in the Nederland Town in the Boulder County in Colorado USA. It is located in the Rocky Mountain area. Nederland is home to the Rosevelt National Forest, Indian Peak wilderness and Rocky mountain national park. The data source is the US Census Bureau statistics of 2010. The 2013 data is an estimate, hence the 2010 data are used.

Demographic of Nederland

	Population	Number	Percentage
1	16 years and over	1,198	82.9
2	18	1,159	80.2
3	21	1,125	77.9
4	62	124	8.6
5	65	85	5.9
6	Total population	1445	
7	Male	749	51.8
8	Female	696	48.2

Number of households in Nederlands

	Household	Number
1	Total household	749
2	Occupied housing	657

Educational status of the citizens of Nederlands

	High school graduate or higher	Both sexes	Male	Female	Bachelor's degree or higher	Both Sexes	Male	Female
1	25 to 34 years	99.4	98.9	100	25 to 34 years	66.2	64.4	68.3
2	35 to 44 years	99.0	98.1	100	35 to 44 years	61.3	55.3	67.5
3	45 to 65 years	96.5	96.1	97.0	45 to 65 years	53.8	56.4	50.4
4	65 years and over	80.0	87.1	73.5	65 years and over	43.1	61.3	26.5

97.2% are high school graduates or higher. 59.4% are hold bachelor degree or higher.

Household Income

Median Household income per Annum in Nederland in 2010 as recorded by the United State Census Bureau was 62, 667 per annum. In 2000, 5 families earned less than 10,000 USD per annum and 16 families earned more than 200, 000 USD per annum. 16.7 % of the citizens of Nederlands live under poverty level.

	Class of workers	Percentage
1	Private wage and Salaried workers	70.6
2	Government workers	16
3	Self employed workers	12.7
4	Unpaid workers	0.4

Appendix A.1.3 Demographic Overview of Hallaryd Parish

Hallaryd is not a recognized administrative area by the Swedish government. It is an old parish designated by the church administration and used by the Municipality for area identification purposes. Hence, data about Hallaryd is gathered from the municipalities and the interviews. Data from the Almhult Municipality website, pegs the population of Hallaryd parish in 2014to consist of 525 people.

Appendix A.1.4 Demographic Overview of Almhult Municipality

Land size of Almhult

Kommune Land size	**891 Km^2**
Number of inhabitants per km^2	18

Population of Almhult

Population	Number
Population of Almhult	15 908
Male Population	8039
Female population	7869

Source (Swedish Statistics)

The municipality has 5 identified areas and the rural population (Glesbygdsfolkmängd). The identified areas and their population are: Älmhult, Diö, Liatorp, Eneryda and Delary. Älmhult is the seat of the municipality.

Appendix A.2 Demographic Overview for Developing Countries

This section presents a demographic overview of the locality where the developing country primary cases are domiciled. Appendix A.2.1 presents the demographic overview of Johannesburg, where JAWUG is domiciled. Appendix A.2.2 presents the demographic overview of Dharamsala, India, where Dharamsala wireless network is located. Appendix A.2.3 presents the demographic overview of Apredie, Ghana. This is where the Apredie community center, the NGO hat owned the Ghana Wireless Project, is located.

Demographic data for the developing country cases was scarce, hence there is less information in this Appendix section than Appendix A.1.1.

Appendix A.2.1 Demographic overview of Johannesburg

Population = 4.4 Million citizens, 50.2% male and 49.8% female

Number of households = 1,434,856

Education

	Level of Education	Percentage
1	No schooling	3.3
2	Some primary school	33.6
3	Completed primary school	5
4	Some secondary school	30.0
5	Completed secondary school	20.8
6	Higher education	5.3

Source statistics South Africa

Average Household Income

	Rand	US Dollars	Percentage
1	2, 457, 601 +	205148.05	0.8
2	1, 228, 801 – 2, 457,600	102574.07- 205148.05	1.6
3	614, 001 – 1, 228,800	51253.68 - 102574.07	4.5
4	307, 601 – 614, 400	25676.97 - 51253.68	7.7
5	153,801 – 307, 600	12838.53 -25676.97	9.1
6	76,401 – 153, 800	6377.57 - 12838.53	10.5
7	38, 201 – 76, 400	3188.83 - 6377.57	14.2
8	19, 601 – 38, 200	1636.19 - 3188.83	16.8
9	9, 601 – 19, 600	801.44 - 1636.19	10.7
10	4, 801 – 9, 600	400.76 - 801.44	4.4
11	1 – 4, 800	0.08 - 400.76	3.1
12	No Income	No Income	16.8

Source statistics South Africa

Employment Status

1	Employed	1,696, 520
2	Unemployed	564, 970
3	Discouraged Work seeker	105, 882
4	Not economically active	855,234

Source statistics South Africa

Appendix A.2.2 Demographic Overview of Dharamsala (India)

Population: 136,536

Number of Households: 31,328

Average household size: 4.4

Citizens employed: 37, 148

Literacy rates: 85.8

Occupation: Government workers, Farmers, Household Industry Workers

Source (Census Info India (2010)).

Appendix A.2.3 Demographic Overview of Apredie

Official data from the Ghana statistical service for Apirede, the host community for the Ghana Wireless Project, could not be retrieved. Data used for the analysis of this case is retrieved from the interviews.

Appendix B. Interview Summaries

In this section, the summary of the transcribed interviews gathered in this research is presented. Relevant aspects of the interviews are presented because some of the information gathered from the interviews were not relevant in the final analysis.

Appendix B.1 Developed Country Case Interview Summaries

In this section, the interview summaries gathered from the Almhult Municipality Broadband Initiative, Hallaryd Broadband Coop and Djurslandsnet are presented.

Appendix B.1.1 Interview Summary with Almhult Municipality Broadband Initiative

Country:	**Sweden**
Person Interviewed:	John-Arne Sandström
Designation of person Interviewed:	Municipality Officer in-charge of the project and chairman of the one of the coops
Mode of Interview:	Face -to-Face Interview
Duration:	1 hour: 14 Minutes

Question: **Who is delivering what, who is in charge of the service?**

Answer: We have a very large landscape and a very small city called Almhut, The commercial Companies, Telia and Telenor etc., do not have enough money digging out in the landscape even the reception of mobile phones is so bad in some of the areas. People complain. In the good old days you had to do only voice, so you had to go out there and nowadays still you still have to go outside. To give you a background about the circumstances, here we have Almhut, the city so to speak, then we have the larger villages like Hallaryd, Delary,Göteryd,Pjätteryd Häradsbäck, Stenbrohult....... in those places we have municipality workers, everybody knows them. In 2010 the politicians made a decision to connect Almhult with the parishes or Villages using Fibre optics where we have municipality work. Basically, you have to put it all together in an internal network to enable them get access to all the servers and work with the services that are here in the house (4:05) but in the same decision they also wrote about the possibility for the areas to connect to the fibrenet if they make projects themselves out there. There are Broadband Infrastructure providers who own cable in these places have fibre in these places, but not in all are not so keen on handing that out to the community. They wanted a lot of money for that. Telia owns the fibre out there. So the community decided to build fibre-net.

Question: **The Intention in the beginning was to connect municipality offices?**
Answer: Yes

Question: **Then you said, we come to the municipality offices, so let us give it to the people?**
Answer: Yes, now we have the basic infrastructure in place so it is now easy for the private homes to connect. But the communities themselves did not want to lead the project like in Hallaryd, Harradsback, Pjätteryd. The people living in the other parishes have decided to take up the project. We have agreed on the terms on which they can connect to the fibrenet.

Question: **Who owns the fibernet back bone?**
Answer: It is owned by the municipality, but the access point connectivity to the villages is owned by the people (communities). In Almhult the communities form cooperatives. We deliver fiber and set up a technic house we are responsible for getting the equipment needed, so they need to get the active fibre cable into the technic house.

Question: **Do they pay for it?**
Answer: Yes, the organization is like this. The Municipality buys all materials that are needed for the cooperative net like this fibre cable, in this we blow the fibre and connection poles where we put together a lot of fibres. We buy it and have a good price for that and the community orders from us ,like they need 30 km of this or something like that and we deliver it to them and they are in charge of putting it into the ground.

Question: **When you say we deliver it for them who does the delivery?**
Answer: The cooperative that digs for the municipality, we pay all the materials through them. I receive an order from the community or not the company and hand it over to the company and the company makes the order and takes it to the coops.

Question: **You are interfacing between the coops and the suppliers?**
Answer: Yes, but the coops are responsible for leading their project from start to end. They have added the drawings and gave the information to the people within that area, asking them whether they want to be involved or not. They have had a lot of meetings and I have attended some of the meetings to inform them on what the municipality is doing and can do for them

Question: **Do all the communities have their own coops?**

Answer: Yes, now, we have divided the whole municipalities into 9 areas. I was involved and we made the borders, so that no one is left behind So these are not geographical borders? We are using the old borders on how we are divided into the church, so we have tried to follow the old formal organization because people feel that they belong in this way. And in these 9 areas, they have registered coops and have registered under state legislations.

Question: **Did the municipalities do anything to encourage the formation of these coops?**
Answer: This area, number 5 here started their coops 5 years ago, before the municipal politicians took the decision. When they started this project they had no way to connect, but they almost all infrastructures in those areas were damaged in 2005 in the storm, they had no phone, no mobile phone. After the storm, Telia announced that they would not rebuild the phone net again as it cost too much money, and the technic is old, that was 10 years ago and even older now there was a lot of damage and there were few people living in this area, so they do not have many customers. They promised to do what they can but know that within 10 and 15 years it will all be gone.

Question: **How many people live in Harradsbeck where this happened?**
Answer: There are approx 4 or 500 homes where people live all year round and the rest are residents with summer houses by the Danes or Germans

Question: **By Law Telia is not forced to supply them?**
Answer: Yes, it was taken to court and the court decided that Telia had no obligation

Question: **They had no obligation to offer basic telephony?**
Answer: What they did was to offer the so called permanent mobile function on the house, they had an antenna on the roof but it was based on the mobile net. For the first 3 or 4 years, it did not work at all. Many people got rid of the antenna and got rid of the phone and got an alternative that did not work Today they have fixed it.

Question: **The 400 or 500 is that the approximate number of people living in other demarcated areas?**
Answer: Yes, approximately when all these areas are ready with their project, we estimate that 15 to 1600 homes connected to the net, that is about 50 not 60 percent of homes connected. We have a problem in the bigger villages, they feel like they are living in the city and the municipality should provide everything. In the small villages they do not expect the municipality to provide for them, they build the network themselves. The level of interest and cooperation to do it themselves is not so high in the bigger villages.

Question: **What is the general level of response to the call to form coops?**
Answer: So let's say about 50 %, but a little less in the bigger villages, but 70 to 80 percent of the landscape.

Question: **Did you have communities where you struggled to sell the initiative and the communities that just accepted the initiatives?**
Answer: Many of those communities, they had not started the process, when we gave them the opportunities. No 5 had already started. I live in, number 4 (Stenbrohult) we also had many problems after the storm and originally I come from far up north. In my village, the municipality built fibre in 2004, 2005, and 2006. So I had the background. So as soon As I heard about the municipality initiative, we decided to go along with the municipality. So no 5 and 4 were on track first, then it took over a year, then the other areas joined in. I did not work with municipality at that time, but we had a coop and I was the chairman, so I and the chairman of number 5 were invited to speak at meetings at the other areas together with the person working for the municipality at that moment. The municipality used the meetings to engender interest in the other larger villages by using people from the smaller villages? The municipality invited 1 or 2 persons in each area to meet in this municipality office and presented the initiative and the possibilities it gave them.

Question: **How did you find these people?**
Answer: In Hallaryd for example, they already, for example, had some kind of organization in their meeting place. We had names and we invited those.

Question: **Did the meeting create coerces for them on the technic or it was just talking together?**
Answer: It was just talking, in those early meetings, often it was only one person that was interested in the technic then the projects depend on them? Yes, you need those nerds

Question: **They are not paid**
Answer: Yes, they work voluntarily

Question: **From the municipality point of view you are not dependent on this people?**

Answer: No, from the municipality point of view, we are not depending on them, but in a long term perspective, if the whole municipality is to continue existing then there is the need a change of technic, as the municipality cannot be a company. So they you need the technical knowhow as well

Question: **How did you identify the individuals, what was your selling point to the demarcated areas?**

Answer: The selling point was primarily that somewhere between the storm in 2005 to 2017 or 18 almost all telephone cable net will be taken down, what will happen after that. We knew that at that time that it was not just the storm that led Telia to take the network down. They already had a plan that if the technic is so sold that they can't get spare part today, they have to get one down to get spare parts to get spare parts. That was the no 1 argument; you will not have any infrastructure besides the poor mobile service.

Question: **Do these parishes have any form of government there?**

Answer: No , not in that kind, they have this old organization to decide to have a party once a year and how to maintain the house that they meet for different people. We invited the chairmen of those groups, and we asked them to find suitable people for the project.

Question: **Do you have an idea of what motivated no 5?**

Answer: It was basically because they had no infrastructure up to 2005. Since the court decided that Telia had no obligation to supply, they realized that if they do not fix it they would have no infrastructure

Question: **Could one say that other similar community initiatives in Sweden also played a role in they in 5 deciding to build the network by themselves?**

Answer: Yes, we in 2010 when the municipality took the decision, we were late compared to other municipalities up north, Up north we have big landscape areas. We learnt from those initiatives

Question: **Why fiber?**

Answer: It is the best existing technics.

Question: **What of wireless?**

Answer: In 2000/ 2001, the municipality had a wireless network and today the municipality can't find spare parts for it and the capacity of wireless is less. The wifi technic, the area is too big and the signal is too dependent on the pole, we try very hard not to divide people into A,B,C, D where b has to receive less than A. In almhult, the Telia can make money by themselves, everybody will have 4G many will have fibre if they want to, but we all pay taxes, so we have the same

Question: **What was the organization when you were deploying wireless?**

Answer: It was a whole municipality project all the way

Question: **Have you had complains from Telia indicating that you are competing with them?**

Answer: Not so far. The regulation based on EU rules, is that where there are commercial possibilities we can't compete with tax money, but if we can define or identify an area where commercial initiatives will not work we can't use tax money. Coops that are now digging such as 2, 5,4, 7, 1 all get subsidy from the EU.

Question: **Are the communities also getting fibre connectivity from Telia as well?**

Answer: Not today, today the municipality has made an agreement called a Swedish company

Zitius, Zitius puts all the technic needed in the technic houses. The municipality does not own anything, they have the support there 24/7, they have a briefcase with service providers like Telia, Universal teecom, Bahnhof lda, viasat, risknet, alltele, Bredband2, T3 and we have an obligations to them that they provide 5 competiting service providers on internet, 5 on IP telephones and 2 on IP TV.

Question: **So the public financing is only for the backbone network?**
Answer: Yes

Question: **Do the 5 ISPs, 5 IP telephones and 2 IPTV have access to use the fibre?**
Answer: Yes, they reach Almhult in 1 box here, and tele2 is the highway to Almhult so Zitius buy capacity from tele2 to reach Amlhult and then to supply to our fibre net.

Question: **Does this mean that the end user (community) will not have to pay much to access the service?**
Answer: No

Question: **However, they pay one amount to have access to connectivity and service?**

Answer: They pay one fee to be connected to the backbone, then we offered them that the municipalities will take care of all the services in their own fibrenet, so they pay a small amount for each customer per month. We have built a support organization so if one digs the fibre cable and tears it apart, then we have an organization, 24 7 that can repair it.

Question: **But they pay for that basically?**
Answer: Yes, they pay for that because if they did not pay up, then they will have to pay someone else. So now we can make a deal on the whole area and make a better price.

Question: **So they pay for connectivity and they can go to the individual ISP to pay for the service, so they pay in two places in reality?**
Answer: Yes, they pay for the maintenance of the fibrenet itself, and they also pay for the service from the service provider, they may need different data rates

Question: **Do you decide on foot service packages they can pay for?**
Answer: No, the service providers decide that themselves, so we put the basic layer, asking for the minimum no of the service provider.

Question: **Which stakeholders were involved in this project?**
Answer: We looked around. We made an active decision not to invite Telia, earlier in the process the person before me, invited Telia and Tele 2 and he explained the plan and how the municipality wanted it to be done. Initially Telia were no interested if is an open net that people has to compete with others. However, we are keen on being the provider and being the only one, after that Telia had reorganized and made a new division for open net, I think that they realized that they need to because open net is spreading even though Telia is trying to buy them all. So we were looking around so we sent out an invitation to 4 or 5 companies, there were a lot of questions and they also put a price on what they will pay as a feedback to the municipality. In the process, we picked Zitius.

Question: **Is there a place we can see the list of current service providers?**
Answer: Alhmult.qmarket.se. This is the service portal for Almhult

Question: **Do you have a time frame for this project?**
Answer: The decision in 2010 in the municipality strategy so to say is that 2014 is the last

year. At the end of this year the backbone should be in place. That was the number one decision and hopefully the coops on the road. Now last week there was a decision by the politicians to start a municipality owned company to take over and go into 2015 and so on. Now we have made a the politician fulfil their responsibility to get the backbone in the place now we are now going into the business part and they think the municipality owned company is the best way to go.

Question: **How much work has been done so far in building the backbone?**
Answer: We have done 170 km and we have about 30km so we will reach the goal

Question: **You have been referring to the politicians, are they the municipal council members of country members etc.?**
Answer: The municipality

Question: **The EU funding comes to you the municipality?**
Answer: No, it comes to the county and all the coops have sent an application to the county and the county decided who will get the subsidy?

Question: **And they will get the subsidy?**
Answer: Yes, at the end, yes. The reason why 3,6,8,9 are not digging at the moment is because the county ran out of money, now the EU is going into a new budget period, so we are in the gap between so 2014 is almost the old year for those who did not get the old money. Because we do not the framework or the regulation so they will not be in place till September or something like that,

Question: **But how important are these EU subsidies?**
Answer: They pay about 50 percent, most of these coops that are now digging, the house owners pay between 20 000, 26 000, 27000 Swedish Crowns to the coop. For the fibre connection. The county decided that anyone getting subsidy must pay at least 20k Swedish crowns themselves, everything more than 20k can be paid by subsidies.

Question: **So the members of the coop 50 percent collectively**
Answer: Yes, the municipality took the decision that it should be the same price for everyone within the coop. Coop funding may differ. But the issue is if you live in Hallaryd all must pay the same amount else the municipality will not collect

Question: **If EU funding goes from County to coop where does the municipality get money from for infrastructure?**
Answer: When we connect them to the backbone, we send a bill to them, where they pay approx 8k for each connect house. The money consists of access to the technic house, service, material, fibre blowing, etc. We do not count on each coop on what they order we have a flat rate. The backbone is paid by tax money, a decision was made to invest 40 million Swedish krones on the backbone and in helping the coop to get started, but everything above 40mill should be paid by the customer in the network from a 30 year perspective, today we have a budget of 72 to 73 million all together. That is money spent without the coops having to pay back. The main point of doing this was to connect the municipality working station.

Question: **So the amount gathered from the members is those you recoup for investment in the backbone?**
Answer: Yes and for the materials provided to them

Question: **You financed Zitius initiative in the first round?**
Answer: Yes, we did so

Question: **Looking at the solidarity, do you have anything that regulates the pricing on how much people should pay?**

Answer: No, not really, but if you are a customer in q market, you have the same price for the same service. But for access, it is not in the strategy for 2010, but we are building a fibre network in Almhult as well, it is very slow, but we try to do it if we have time for it.

Question: **Why do you do it as Telia already has a network there?**

Answer: In the newest housing areas, when the construction started, they wanted to be there, but in the old areas, there is no fibre in some of the houses many houses live there. The municipality company made an agreement with tele2 to build a fiber net almost 4 years ago there and own it for 10 years and after that the fibre net goes to the municipality company. Otherwise Telia is not there

Question: **But when you say that you can define areas that are commercially unviable then you can build your network, how do you do that in Almhult town that is commercial?**

Answer: We cannot use tax money here, here in need full paper. But we take the initiative too. If someone phones me and say can the municipality build a fibrenet here is there is enough interest in this area. Then we say if you get 50 percent, then we can do it, even if it might cost a bit more to reach this area. We have made calculations on different areas to see what is the cost of building inside the Almhult. From those calculations, we have decided that 25000 if we get at least 50 percent and if we get more than 75 percent in an area we can offer them a connection for 20 thousand. But you see there is a connection to the cost in the landscape. Coops build for 25k and they cannot be cheaper than 20k, the county has decided we have tried to see if can see the same model in Almhult. If we decide to make it cheaper in Almhut and ask them to pay 10000, people in the landscapes will say we pay as much tax as they do why we can't get it for 10k also.

Question: **What is the average income of citizens in Almhult?**

Answer: If you have full time work you earn between 240k up to 500k a year before tax. We have a lot of people with high income due to IKEA. But many families do not have 2 persons working full time, only about 50 percent have 2 families working full time. 20 to 25k is a lot of money

Question: **How much does in it cost in areas that Telia covers?**

Answer: Telia takes 17k but they try to take the best part, if you a customer in their net, you can only use Telia as a service and they will get their money for the time subscribed for.

Question: **Does the municipality have other plans towards rolling out infrastructure?**

Answer: Now we see that we will have an infrastructure in place, there is an ongoing project in the house on future e services. Today you can find a formula for anything on the net and you can type on a writer at home, the next step is to fill it in the PC and press the button I spoke with the head of IT and he said all the formula will be online. There is also within a healthcare project in Sweden as a whole about healthcare in your home based very much on e-services, you can measure your blood pressure while connecting online at home. The initiative is driven by the country and the region. We have alarms for elderly people and most of them are connected via mobile phone and the techique is already in place to put to the fibre and if a person has not moved in 45 mins, it can start the camera, so someone in the hospital or elderly home can check to see if something is wrong. Of course, there is an integrity part, but it is absolutely possible. That is why it is important that everyone has connection got the infrastructure.

Question: **Can someone pay the 25k without using the service, do they have any running cost?**

Answer: No, because you are not using the service, but they need to stay a member in the coop, and pay membership fee of maybe 100 or 200skk a year. This is because there are not so many elderly people who realize that it is important to have a connection, just like electricity, etc. but they don't have a PC, they do it for the next generation. It was decided that they don't pay for the service (1000skk a year) if they don't use it, in the big picture it is not so much money for the municipality. But it is important that they are connected

Question: **What happens if someone comes in 5 years time and says, I also need a connection?**

Answer: Out in the coop should have made the regulations themselves. They own themselves, so they make the decisions

Question: **Have you thought of escalation of cost over time or the lowering of cost over time, do you have price caps?**

Answer: No, but we have a 3 year contract, if we see compared to other close by areas that Zitius is becoming too expensive for our customers we kick them out once the 3 years is over

Question: **How long does the municipality intend to be involved in this business?**

Answer: When I spoke to the politician's leader, she said the municipality will never sell the infrastructure. I agree with her. We have seen what happened to Telia for example, earlier, Telia was owned by the government and we had control over the infrastructure, now Telia is in the stock market, declaring every 3 months period, of course they see, where do we earn money and where do we loss money and they lost a lot of money from the old telephone network so they took it away.

Question: **Now till 2015 when you are looking at the business part of this model, will you still have a separate company managing the infrastructure and another agency managing the administration as it is done now?**

Answer: From where I see it, I think we will still outsource infrastructure, we are not big enough to have 24 7 support for 2 to 3k customers and the technic ages quite quickly, so I do not think so. And from experience up north where the municipality manages the infrastructure they have problems getting the most well known service providers in their net as they have not been able to provide potential customers in their net. In our case the municipality will own the fibrenet and try to make the best business out of that both with Zitius and to another competitor, but it might become big business if we rent the infrastructure between 2 spots. As someone will sell their services to IKEA maybe, but they will need a connection to IKEA or any other company as they get the connection from Stockholm or Malmo or somewhere. To get to Ikea or Almhult they need to use the municipality'S fibre net.

Question: **Have you had an experience where the coops run out of money or are in a financial difficulty?**

Answer: Non has any problem yet, when they ran out of money, they stepped on the brakes and stopped digging. They apply for more money from the country and they were granted the money to continue digging. We have not had a major problem yet, but if it comes, we will have to do something about it. If someone runs out of money, we can loan them money, then they can pay back over a number of years. We provide a lot of help to them

Question: **You have staff working with you on the municipality on this project?**

Answer: We have a small organization, I work with 50 percent pay more or less, make it happen they say. I have another partner, who is more responsible with what happens in the field. He also works about 40 or 50 percent. One full-time

Question: **Who determines the right of way in the process of digging?**

Answer: In the coop area, the coop has to reach an agreement with the landowners, if you dig along the bigger roads, we have the Swedish board of roads the coops apply and then they get n answer.

Question: **Is there any Swedish law that permits municipality investment in public infrastructure?**

Answer: Yes, there is some recommendation, I do not know if it is a law on how the municipality should work within telecom and fibre. The main thing is that in areas where the commercial interest is not working, you can use the tax money to build. After building, you need to run it. But the municipality should not play the part that Zitius is playing for us. It is allowed, but it is allowed, but we should look out every 3 years to see if there is a private company can play that role.

Question: **What is your background?**

Answer: I am a farm both from up north from.. I studied economics, and worked as an accountant for 5 years. I moved here down south in 1997 with my wife. I have been running a milk farm for 6 year, after I worked as a senior advice within economic and business development within agriculture and forestry, today I run Forestry Company, which walk with kilning and the reason I am here was because I was involved in the coop 4 and the person who was here at the municipality decided to do something else within a short notice, they needed a solution quickly and someone who has in the process so I was invited. Now I am in it.

Appendix B.1.2 Interview summary with Hallaryd Coop treasurer

Country:	**Sweden**
Person Interviewed:	Asa Dahlström
Designation of person Interviewed:	Treasurer, Hallard Broadband Coop
Mode of Interview:	Face -to-Face Interview
Duration:	54 Minutes

Question: **What is your coop all about?**

Answer: There was a meeting with the kommun, there were gathering all the rural associations, at that time I was not on the board and I did not know much about it. Suddenly we got a paper in the mail that in 2020 the telephone lines will be put down, because there is new technology and they have not been updating the existing service station. We were offered Fibernet instead, so we had to make the association with all the work and extra cost. The kommun did not want to put the effort into it or did not have the possibility to do so they put it up in the deference there was a young couple who were very eager to get started, so they had a meeting in march 2012. And then I was the one of those that volunteered, so we started a working group, so we sent out an interesting note so that people could sign up. Everyone got the notice about the telephone line that would be put down and everyone realized that we needed to have some form of communications in many parts here, the mobile telephone is not working so good. Many of the young people were interested in having it elderly people that were fine with their mobile phone, they can cope or maybe do not have money to put 25k into the project to have internet.

Question: **Is there an amount you have to pay upfront?**

Answer: Yes, we have to pay the digger for the materials needed in the project.

Question: **You have an association and the board and the kommun approached you?**

Answer: Yes, the first association was Hallryd but they were not able to provide information, so a new board was formed. I do not know how the young couple was connected from the start, maybe they had been to the commune earlier. When the working group started more people joined up. A lot of competent people joined the working group. One is the individual that made the homepage hallaryd.se. He has put a big lot of work into the project as he is in the planning group. We found that there was enough interest to get contributions then we decided to create the fibre association. Due to the contribution, if we had more than 200k euro, we had to make a common purchase and just to state that the contribution because we counted on how much we had to have in contribution, we had to part Hallryd parish in 4 pieces we had too much digging work to do and we had to stay below 200k euros. So we have 4 different associations just for Hallaryd.

Question: **Is it because it is popular?**

Answer: No, because it is more expensive, there are large spaces without houses; hence we need much money to contribute.

Question: **If it is more than 200 000 Euros what happens?**

Answer: Then you have to go for procurement. We do not want to have polish diggers; we need local diggers who know the area

Question: **How many people are in one association?**

Answer: 35 , 40 up to 50 members in each, some members have more than one connection, ex we have two houses, then if we have 50 houses, there will be about 55 connections. 25 000 SKK for each connection. For example, in my house, I pay 50 000 for connection

Question: **Which of this 4 association relates to the commune?**

Answer: They have 2 from the start and from the start they had people on the 2 boards and they shifted the chairman. We do the same, and they belong to each board as well. There is a common secretary and common treasurer. That is me. I have a lot of jobs in terms of payment, invoices etc.

Question: **How far is the project?**

Answer: They have already started; I have issued the first invoice, now i am waiting for the money.

Question: **How is the money raised?**

Answer: That is the problem, you do not get the contribution at hand, you have to pay, then you show the invoices and then you get the money. You get the money for the involves so you can pay the next one, now we are a bit late because we did not know he will be fast. He was the same digger at Delary, he worked fast due to the fine weather. We are taken by surprise, so we had to issue the invoices to our members because they pay 5 as part payment and the 20k as soon as they start to dig, as we have 30 days payment so it will be, we have to wait for the money so that we can pay for the invoices. That will be hard work

Question: **The 50 members is that all or half of the population?**

Answer: They are not so many, in total there are 150 to 170 members and I think they are 350 households in Hallaryd with people who are staying permanently some of the summer houses also have connections.

Question: **How did the people in the community accept the network and what are they looking forward to?**

Answer: They want a good telephone connection; they can also have the internet and tv. If you are elderly you can have a security alarm. I do not know the cost.

Question: **How about right of way?**

Answer: You can go to the lands commission. To get the connections right, but that costs, In the contract with the members, they are expected to allow the digging on their land.

Question: **But are people positive to digging?**

Answer: Yes,

Question: **Are they receiving money for digging through their land?**

Answer: No. they get the honour to say I have a fibre cable in their land

Question: **When will the fibre get here?**

Answer: Late summer

Question: **When do you hope to see the digging completed?**

Answer: November, we have to cost and contribution shall be exhausted by the end of the year

Question: **How is the county funding, helping?**

Answer: We have to present the paid invoices before getting the money, we have the possibility of getting 200k in advance, but the invoice was over 500k, so 200 is a drop in the ocean. We have been talking to the bank, and they have given us the possibility of taking a loan and using the contribution as security but it costs extra in interest.

Question: **Is the commune aware of this challenged**
Answer: Yes

Question: **In what way are they helping ?**
Answer: the paid invoices before getting the money and fibre blowing and also the connection at the house with the operators. So that part we the association gets money from the members and we pay for the cost

Question: **Do you have any working model because this is infrastructure is yours do you have a model on how to sustain it?**
Answer: Well,the agreement with the commune is that the commune maintains it, as long as the net is used, the operators providing the services will tell us who uses the net and at which time and the members pay us and we pay the providers. Because they will charge us for the cost

Question: **Do you have an idea on what they will pay?**
Answer: It is up to the members on which services they will use as there are different services and data capacity. We pay 8000 SEK per month to municipality

Question: **Are you all volunteers?**
Answer: Yes, we get EU money for associations working along with all sorts of projects, we have some money during the consultation and information part as we still have to inform people as we work.

Question: **How much?**
Answer: It should cover our costs. We have been sponsoring for the cookies at the meetings

Question: **You don't depend on EU fund?**
Answer: No, cos we have the 200skk each year. We think this year there will be coffee for meetings. Otherwise, there would be more administrative costs.

Question: **The EU funds pay part of the digging cost?**
Answer: Yes, we have to pay 20 000 Skk. We have the goal of 25Skk. If it is less that is good. We have the waiting list so if it is possible to get the members on a durable cost that will be fine how much does it cost per line kommune pays for materials. Total cost for each association is about 1.9million SKK or thereabout.

Question: **Do you chose the diggers?**
Answer: Yes, we find the diggers

Question: **Who does the quality assurance?**
Answer: There will be some kind of control at sight, they will look at it, when you are going to blow the fibre, if the pipe is bent, and you can't blow it. If they don't get it right then they have to make it right.

Question: **Do the diggers have any education?**
Answer: They must have

Question: **Do you meet to choose the diggers?**
Answer: Yes

Question: **For the association do you have tenure for the executives?**
Answer: Yes, 2 years and the possibility to be re-elected, you can also drop out and they will have an extraordinary meeting to note a new exec. In May, we will have the annual meeting and all the four will come together.

Question: **How do you intend to keep the people informed?**
Answer: Our home page, the meetings, before the start of the digging we had a meeting, we sent out a mail with the membership fee. We were to put an advert but forgot, but still more people came.

Question: **Are people enthusiastic about the service?**
Answer: Well, we have to wait, we have tough people. There was a problem at the start when there was a school at Hallaryd where the school was to have internet they put a mast, and they got radio signal to the mast to the station. On an occasion where there was an extra place for more people to have it, the ADSL I was one of the people lucky to be connected but is would not be as good if I had mobile connection here. The young people they have connection, called nets x in their marketing they say they are the best, but you have to stand outdoors to get 1 MB, in a good day you have 3 MB and on the weekday, it fluctuates, but with the ADSL I have 5 to 6 MBs that is why I need fibre net for a better connection

Question: **Does the association have an office?**
Answer: No, we gather about 7, 8 9 of us, we host at member houses and they provide coffee and cookies. There is no administrative cost there as that is more of a social thing. People are grateful in the parish for the good work. The association is like 4 companies and we have 4 treasuries. I have connections with the tax authorities, and the authorities. If something is changed in, the board, we have to go to the association that register companies and many other agencies.

Question: **What is the biggest challenge for making this work?**
Answer: We are lucky to have this guy who is good with the internet, I am not sure, but I think he is an engineer and he has made a big part of the work and has the competence and the time to do it, without him we would not have come as far as we have done, we have applied all the contributions and measures the parts that will be dug and checked the materials.

Question: **Will the municipality not help?**
Answer: They don’t have the people for it.

Question: **You are quite far?**
Answer: We are almost done. We were lucky because of the agriculture programme from EU runs from 2007 to 2013 or 14 and the new programme was delayed so 2014 was likely no money, we were lucky to get the last piece of the button. We were lucky because we had to wait and you don’t get the money in 2014 in our contract we hoped for 2013, to make sure people do not drop the interest, we slated the completed date for 2015, so people would not ask their money back. We were lucky. We had the help from fibre handbook on how to form associations, it helped us

Appendix B.1.3 Interview summary with Djurslandsnet

Country:	**Denmark**
Person Interviewed:	Bjarke Nielsen, Stephen
Designation of person Interviewed:	Founder/Former Chairman of Djurslandsnet and Former volunteer respectively
Mode of Interview:	Face -to-Face Interview
Duration:	54 Minutes

Question: **Can you tell us about the history of Djursland?**

Answer: The map we see is from May 2007. I do not have the common map because in 2005 the network was decentralized and from one network established by me it was formed into each board with its own local area. At a time it was 10 networks actually based on the original 8 municipalities of Djursland. We had 8 municipalities and they formed themselves after the municipality reform. We now have 2 merged municipalities in 2007. We now have the Nordjurs and Suddjurs municipality. When I started Djurslandsnet, I saw it as a whole without looking at the borderlines. People agreed to it, but when the municipality reforms were promoted, it meant something to the volunteers in our network. So they tended to go to the south or the north. Here you can see the maps for the nodes from the North and the south. This map shows the nodes. We have one omni-antenna, in other places several directional antennas. We had 250 overlapping nodes, but today in the whole of Djursland, there are about 500 nodes. 2 of the municipalities, Nore Djurslands municipality, Rougso municipality and Sonderhald municipality from the Primanet. The 1st municipality called the Sonderhelds net, now they are known as west Djurslands net. They have combined recently Rosenholm net as you see it goes all the way to the southern part, so the name is alright, West Djurslands net. Here in the south, I called it Ronders net, when we were divided, they are called Egensnet today. They have integrated with another network in the countryside with villages. I could see as the then chairman was that it would take time before they got the service. My intention as the then chairman was to serve them with the service. This was my aim, but it was a contradictory that they will come last. We formed a board and named the coop Egensnet number 9, because we had about 8 already. Out here in Grenaa, I was also chairman in the network and it was difficult to establish the network here because it is a city and city people want people to do something for them. I don’t think so, nobody will. In the countryside, people know they have to do it themselves. Grenaa and Ebeltoft were late to start. I actually made boards here before we actually started a physical network. The last thing i did with Grenaasnet before I retired, when i retired there were about 30 nodes, today there are about 80 nodes. The others have not made maps yet the same goes to the middle community which is the Middjurslands net. Today 10 000 households, firms and institutions is connected to this technology, it gives access to about 1 third of the population of Djursland, It is a huge network. It was a huge task. The opportunity to do it was based on poor people who decided to do things themselves. Today, several volunteers are involved in the network. They are involved in such a way that they are involved in their own area, their own local area.

Question: **The 1 third, is that the actual number of subscriptions?**

Answer: We are 82 000 living in Djursland. But if you look at it at household level, we have about 30 000 households. 10000 connections are made by those 500 nodes, each node serves 30 customers be it family company, institution, etc.,. It had to be that small because we are not a commercial entity. To ensure quality of service, 30 users per cell site was was max. People have access to 12 to 16 MB downlink and 10 to 12 MB upstream. The very important feature that i had to commend everybody from the beginning was that we should have more or less synchronized so each board could have their servers, so that we do not have to depend on commercial partners. The high bandwidth was necessary to enable a high capacity usage. I learnt this from experience in the 90s. Each should have a high bandwidth. That was the introduction.

Question: **(On our way here, I could see a lot of trees, the settlement was scattered, yes there are also hills. From the technical point of view and using wireless there will be technical issues. You have mentioned that you use a lot of nodes). You have to be technical to know how to navigate the connectivity in such an area? What is your professional background?**

Answer: I am a trained painter from the academy of fine arts in Aarhus many years back. As a culmination of that education, I became educated in the science of creative intelligence in the 1970s. That became the final part of my painter education to become a teacher. We came to the practical part which involves deep meditation because through deep meditation, you can power your creativity. I was coordinator of teaching and meditation in the middle region of all Djursland. At that time, we had collective teachers and we were able to go to all parts of the city for 7 years. In this organization, we had a conflict around the status of a teacher, I made a report that redefined who a teacher should be. The idea was that you should not consider yourself more than the students. We are equal and there should be democracy. We may know better, but it will not change our subjective status. Teachers in Copenhagen had an opposite view that the teacher should be higher. I lost the dispute; i did not form the majority so i had to leave. I was sorry for that because the organization became a self-sufficient entity. This was about 1980, so I considered what to do. I decided to make a perpetual energy machine my idea was not speculative, it was that i could make some type of start-up that could make energy, if it worked out, i would rent it to industrialized countries and give it for free to developing countries so that you could have tools for a kind of motor. I tried with magnetic energy, gravitational energy. Within that time, I tried all sorts of energy; my father had all types of tools. I could go there to do my experimentation. At the end of the 1990s I decided to make something useful. I think I will find the energy solution. I do not believe in positivist science, but from an interpretive mode. I have an open mind, of the universe. I felt I was wasting my time if I could not come up with something useful. When I was about 20, I was a self-made artist. I considered myself, not a human being, but a being. I was writing a lot of notes which will clarify understanding in our learning, society. The notes were one note per line for the reader to read and understand. My landlord wanted me to make patterns on their window blinds. I had a machine in my workshop that would take the material and make the patterns. In those days oil and turpentine were used. So I thought of how a machine could be made that would make me independent of oil and turpentine. I drifted it into the future in my mind; this was in 1967 to find out how it would be possible to paint the patterns on TV screen. In those days colour TV was new in Denmark. I considered it would be possible to someday paint on the TV screen, so I could get rid of oil and turpentine. I thought that in the 80s someone would be provoked into linking the typewriter with the TV. I did not want to try it due to the failure of my energy machine, so I believe that the technical people would think of it. I did not know it would be called a computer. I just thought about it conceptually. I thought when that is done; I could get my parents to get a loan to buy it. So I continued to write notes about these concepts. The idea was that when I get to 40, I would consider the notes to see if they would be useful. Then I would make use the typewriter and PC to paint different alphabets to make patterns by making sentences on top of the painting. I considered that 1 would use 24 years to make 8808 to infinity concept of the different art concepts. Here I can make calendars with different concepts. That, combined with the feeling not to make an energy machine, so I decided to get the Amiga color computers, when it was released. I considered

Amiga and found that the pixel was not high enough. You could have high resolution if you had 16 colors. If you wanted many colors, you needed another solution. So I stopped dreaming about the machine and I got computer magazines from Germany and I studied the advertisement. The advertisement made me to write about 200 firms around the world to know how I could have a PC with a good resolution. So I ended up to find a solution which was about 60000 Dkk. I took a chance and bought the PC it from the US. I bought it from US cos I could get half the price. The PC was high resolution 20 inches, this was about 1988. It was quite expensive. The monitor was 20 000dkka special graphic cards which could run the monitor was also acquired with the accessories and a color printer. When I put all this together, I had gone an evening school in Grenaa to learn how to use a PC. We learnt it from the Danish computer which was a disadvantage, it was compatible. They tried to have a Danish standard, but it was not possible. So the accessories that were bought from the US were useless because they were not compatible with the Danish computers. So started from scratch, to see if I could have some knowledge. I attended the academy of fine arts in Copenhagen and a school in Aarhus. I had to learn. Later I had to settle with windows because their drivers could go with everything. After something I had everything running, but after every three quarters of an hour the machine froze up. So I had to start all over again. I had to learn how to save to the floppy disk. I asked for help from the experts, but non could help. Some came to my house and stayed all night, but could not solve the problem. At some point I had to call different firms to find out what the problem was. We decided to analyze the graphic adapter. After 2 years the problem was solved. So in the process, I learnt how to configure programmes in the PC and got a lot of experience on the hardware repairs of the PC. When I came around to the local community in 1990, firms were beginning to have their accounting on PC. They had a problem. I came around and told them it was a normal problem, and since I had gone through similar PC problems for 2 years, I could not turn my backs on them. So I sat down and showed them how to solve it. I could find the reason for the problem. This changed my situation from picture painting, repairing computers as I was asked to teach at the local production school and local day high school. We did not have people who knew what the PC was all about, so there was that need to know, hence I was hired. I became a teacher and more than that, because I had many students in different schools. So i met my students everywhere. People would meet me on the street; people will meet me with PC problems. If i was sent by my wife to get milk Ii would return 2 hours later because i met people and i had to explain the problem and solutions to them. Then they said the computer, we teach in school is fine, but when i come home, I can’t use mine. So can’t you make an evening once in a while where we can come with our own computer, so you can help us. I and my wife lived in a small house, so one day i was at Rougso and a student asked for help. He was the chairman of the radio in northern Djursland. We got the school and we began the computer bovl there after some. The community came to be known as the bovl community. In time people began to help. We now have bovl evenings at different times at different evenings. I tell this story because this is how it was possible to raise the volunteer movement. We knew we would be left behind if we did not do something. When we started the bovl, I was an IT teacher. I was considered knowledgeable I was told to form a curriculum for the county in Aarhus to have support for networks, computers, so that we could invite people besides students only to have the feeling of what it meant to use a PC. I made a list of tools and what it would cost us. The County decided not to help because it was not useful. So I decided that it had to be done the hands on way. From this experience through the years 1993 to 2000, we learnt to make our website and not depend on the municipality. Here we could upload different information about the municipalities. People had emails on the website domain name. People paid 20 dkk a year. We had about 200 names with 1/2 a gigabyte free space. The domain name is owned by the union. I pay for them. If anyone wants my support outside the bovl, I charge 100dkk for it. The money pays for the domain name.

Question: **How did the Wireless network concept emanate from the bovl evenings?**

Answer: I had some friends who were into amateur radio and one of them had a walkie talkie computer network. They will take the walkie talkie and use a computer card and an antenna just like the network today. At that time people had modem and they could enter their GPS where they could put their software driver. It was like the internet. The walkie talkie network, you chose the channel and say to everybody talking, don't use this channel it is used for data. Then we had this network and i was communicating like similar to Skype where people around Djursland could call Holland. We had repeaters all over Djursland. I had put out a message about the war in Yugoslavia, as the media were lying. We made a call to Holland to know what was really happening and we got a feedback that there would be a war and that the media was lying. But the experience that with no money, but just electricity have a computer and a computer standing there, but it was slow 1200b per second.

You had to send packages and repeated packages. There was latency on the network. The possibility of what we could do at that time was not different from the internet today. The low speed from graphics was not a problem, we could still use the network cos we used the DOS interface. We could download software northern commander could be downloaded on the network from somebody in Aarhus. So this experience was used at the bovl evenings, so that people will prepare at this time in 1993. I made people use it as a way to persuade them that this was the future. In my dream 25 years earlier written in the notes, Many people did not buy the idea, but later people bought network cards to be connected. The youngster used it mostly for playing games. We had to make extra arrangement two times a month to come and play games. Some kind of maturity will come about I was hoping that the development of this equipment, which was very slow, for the coming for low price fast speed of this device will come. I could perceive this by the rise in demand of other products leading to the fall in prices. This happened with the cartridges, graphic cards, etc. There was an exhibition in Copenhagen, I saw three piles and on top of it higher and higher, there was a cd rom, a monitor and there was a CD writer and they cost 75000 and 80000 dkk per piece. This was in 1987 or 88 and this was expensive and later, they became cheaper and new version came up, today people do not write CD readers anymore. So I could foresee that the radio equipment will be cheaper someday the moment it could be mass produced or mass sold. The price will come to a level where everyone can buy. That happened in 2000, the price for radio equipment was not below 10000 dkk. So i began to prepare. So that when the prices come to the affordable range we can do something about the radio network. We had to be ready with the organization. That when the price gets to what we can afford, we can buy it collectively hence we would be ready, So that was why i formed the Djurslandsnet organization from the bovl organization. I founded it in October 2001. My idea was that the network should be free. But I could not convince the municipality with the idea of each household having internet connection wirelessly. Aside the municipality people did not buy the idea easily, even at conferences. We had a conference in the townhall. 5 to 6 people from the bovl attended the conference. We were to advice on how to make the network for the community. We differed with the municipality on how to make a good community network. After the break we explained out concept, but the administration did not see the feasibility. We did ask the network operators if they would come in to invest in rural areas. I had negotiated with 36 companies to have a conference with them, almost everyone except TDC found our idea very impressive, but when they did the calculations; they realized that it could not be done on a commercial basis because it would not pay off. That was why they decided not to deploy Broadband in general at that time.

Question: **You wanted to have a gateway; you did not really decide whether it would be wired or wireless?**

Answer: We wanted equal terms for everyone; we were open to whatever Broadband solution. My experience with radio technology made me opt for radio. I did not know they will call it Wi-Fi. It was Vic Hayes who made these standards for wifi. They also based their equipment based on the walkie talkie. They developed the standards in the 90s. He was made chairman of that committee by IEEE to develop this standard for public use of radio frequency. They did not know it would be called Wi-Fi because it was a 10 year development before they had something stable for public consumption.

Question: **Why Wifi?**

Answer: Wifi was cheaper. When I compared the different technologies, a cabled infrastructure was the possibility, and fixed line was predominant. We could pay 70Dkk per month for interconnecting to the fixed line infrastructure aside the bills that were bundled with internet access, etc. I was very particular that the cost of using the service overall must not go beyond 100dk a month because the F were rural dwellers. The people in the rural area did not really think they needed the service. So if the cost was high, no one would get it. At that time a 2MB connection was 1150 DKK. My ambition was that every household should have a 2mb connection and it must not cost more than 100 dkk. My idea was that the cost of equipment should not be over 1000dkk one-time payment and this payment should be flexible. There are lots of poor people and unemployment in the countryside. They had a community at that time that is falling apart as they cannot compete with city people. But my understanding was that I could make a change by making at least 200 more employed, I could take the tax rise in the municipality would help develop more roads and keep the institutions alive. Because about 200 more people in these areas paying taxes is a lot of money for the municipality. And actually when I calculated it from today and backwards from the beginning. The organization of these networks around the volunteers has saved a quarter of a billion dkk altogether in lower fee than if they had the opportunity to get the commercial internet. They would have paid a quarter of a billion. It is not important to people in Grenaa or Ebeltoft as they earn higher wages, but in the rural areas, it meant they came to the wagon and they can do things that could be done on the internet to boost their economy.

Question: **Was there any Skepticism in the bovl group about your idea?**

Answer: Yes, at that time, when I tried to convince people from my experience since 1992 with radio networks, in 1995, we started a community web as a homepage thing. I was asked to form a Danish project, where municipalities could apply for state money to become a .. I will explain it this way, the idea was that the government to bring about development to the rural community, they were asked to form at least 4 projects for each and apply for money for each project that will facilitate this type of development in rural areas and 12 municipalities applied. I was asked by the local municipality where i live to make the bovl community make a project which will be about young IT access, we did not have a board, we were volunteers and i was the initiative taker. We formed a kind of board to decide if we could go into this or not. We decided we will volunteer and have a young nerd, give us a kind of IT housekeeper for the municipality. We were given a little more than 500 000DKK over three years to buy equipment and provide internet cafe services with 12 machines and networks. This was 5 or 6 years before the Djursland net. I was the project leader. We had the young guy paid for from the project. He became my opponent. He said wireless network was not possible. We would have to share the network and the QOS will be bad. We had a lot of dispute about what was possible. I was open minded about it and we decided to take the initiative based on one or the other, we had people coming to our workshop to explain how it could be done on cable and different kinds of wireless. So there were opponents in our own group, but the contention was just about what would be useful. Then the business community of Djursland had a conference in the middle of Djursland. We had people from Copenhagen, it was an expensive conference in 2001. We were 18 people from Djursland, 10 from the bovl community. I was made the spokesman for the group.

The chairman of the conference of the conference did not give us the chance to speak; we were prepared to share our ideas. We had 10 to 12 volunteers from the municipality project alongside the paid nerd. The volunteers worked on different kinds of arrangement in public administration. Due to the unemployment, these projects gave them room for work experience. We had a lot of work hours. I worked more than 100 hours a week around the year. We had put a lot of time to develop and explore our plan, we placed our charts on all seats. The charts showcased different scenarios on how Broadband could be developed in Djursland. We had carried out research on how this could be done. We knew what it would cost; we knew what it could do and so on. Of course it was important for us to have the conference to understand it. So we did not have wait for people in Copenhagen to come and help. We are not familiar with people in the city. We had to do things for ourselves. They have always said we should work together to be a part of the agenda, but we are always so low on the agenda that we often do not count. So have made arrangements, talked with journalist and newspapers. It was strange that we were not allowed to speak. However, after the conference I spoke with one of those on the panel and one of those on the panel was a high administrator in the county in Aarhus who were preparing fiber access between all the hospitals. They wanted an electronic patient journal. They had asked TDC to make a fibre between all the county hospitals and health houses and it was so expensive that they decided in the county to do it themselves. But we ended up having this fibre coming from Randers and returning to Arhus, and from Aarhus to Viborg and from Aarhus to Silkeborg and so on. I think Viborg was not a part of it as it was a county, then, but Silkeborg was a part of it. This fibre ended up to be made, so i jumped at the county administrator who was on the panel at the conference, in the break and asked how can the bovl community, be part of the fibre because we wanted to make it accessible to the community. He was laughing ahead, because it was not possible, and where would we get that kind of money. I went to meet him at the office. We continued to cross each other's path. So he ended up coming to a conference organized by the administrators and politicians in Djursland and he sat on the panel there and I was the chairman of the conference. When he started to talk about it, he said I may be the last cooperative (as a joke). The conference in 2002 made a step for us. At the first conference, the chairman was the director of the business community of Djursland. It was his responsibility to follow up on that conference but did not, so one or two months later. I was called for an activist conference. In the mean time we prepared even more technics and we had started to take signatures from people. People had to sign if they wanted to have cheap internet at home. We collected 625 signatures per household. We had all these signatures and materials at the activist conference. Then we had certain aims they were to expand the quality of citizens in Djursland, keep the citizens in town and draw in more citizens to Djursland to aid the tax net, this would curb rural urban migration, it would improve and grant employment, To keep businesses here in Djursland. Avoid youngsters leaving us forever. Keep and draw on tourist. These were the backbones of the points we created in 2001. This is important as we had an IT community of nerd, we had to shape them to have a social dimension and we could use all we know about IT in our daily lives. It helped us form the points. We presented it at the activist conference. We had 23 point of mission, which we wanted the activist point to present to the Internet provider. We will not go for anything less than Broadband uplink and down link. We wanted to give a technical clue on what we were going for. We needed to be correct from the beginning. We made a big impression on the 40 people. So the director of the business community divided us into working groups. We wanted the Djursland business association to help us champion the course as they would be beneficiaries as well. This decision was important as we wanted the municipality involved as well. For us, we wanted it to be a Public private partnership. So I called on him several times and could not connect with him after the conference. In the middle of the summer, i eventually got hold of him. I found out that he had not even written down the role the activist would play. The conference, to them, was just a make believe thing and not an important thing.

He was the director of the business community and he would have helped. All this month's we were in our workshop, 10 to 12 people trying to get the best knowledge. We had contact with parliament and the ministry of research and communications. And we met all the time people, but the people did not really care because it was parliaments policy that telecom infrastructure community should be handled by the business community themselves (market). The municipality was not allowed to support the initiative as that would be interference. Hence it had to be handled by the market. At that time we met, the network providers and even TDC told us it could not be done. Hence the public sector could not help. It was strange to me that they said it should be handled by the competition and none in the private sector were willing to do it. They did not see the business sense in it. Then at that time, I had to report publicly to all those who had signed up on the outcome. The 625 people as time had gone by. So i called a meeting in the municipality where we had the bovl and people came and i had to report the situation. When people learned that our efforts were unfruitful. People became upset and ideas came up and they said they will do it ourselves. Someone suggested that we could form a union. One person suggested that we could call it a Broadband Union and another suggested DjurslandsNet and we ended up having the Broadband union Djurslands net. So we formed an intermediary board as we knew that we had to get everyone in Djursland involved. We sent people to different communities to find resource people and that was the board's goal. I took the bovl out there to wherever they could find.

Question: **Did you draw the network with the Bovl?**
Answer: Yes, because it was developed 8 to 9 years earlier. People came from Aarhus from Silkeborg to our bovl. When we said we can be done, people trusted us. Even though they did not know how it could be done. The attitude in the bovl community was that we do things before we had a solution. This attitude was so pleasing to people who had a problem, hence there was trust. This helped us draw people. In Spetember 2001 we had major separations. We had a general assembly in the bovl hall founded the Djurslandsnet, the Broadband union. I could draw a lot of people because I had helped every kind of people within the 10 years. We had a lawyer helping us with the legal work, We decided that the union was not to be very decentralized in order to have local people involved, so that they could form their networks. So it had to be a union of several organizations. So already from the beginning.

Question: **Were there threats from the network operators to stop you?**

Answer: No, not on the open. However, in the organization part, we had 8 sub boards with each having 2 representatives in the bigger board. So we had 16 representatives from the boards to form how everything should be done.

Question: **How did you acquire the equipment?**
Answer: We bought some of the antennas, but we fabricated some of the directional antennas. We opened it once and we found that there was nothing in it. So we duplicated it and had children from the technical school help us make more of it. We still bought directional antennas, but they were few. It made us save costs.

Question: **Do you have a way of managing user experience?**
Answer: We have volunteers in each area that connect the call the free volunteers. The volunteers know one another and can contact each rapidly.

Question: **Are your volunteers technical people?**
Answer: Yes, some of them are, some of them are involved based on interest. Some have other jobs, but are connected online to monitor the network.

Question: **How do you monitor user payment?**
Answer: First, they get a monthly bill, if they default they get a reminder. If they fail, they get disconnected from the central point.

Question: **What if the defaulter hosts the omni-antenna?**
Answer: It doesn't affect the dependents as his or her IP address alone is disabled.

Question: **What happens if a user decides to unsubscribe?.**
Answer: The volunteers can take it down or they return our equipment. They get some of the excess money back. They sign a user agreement. When we had the organization, we wanted to have a pilot project in the town where we had the bovl, here we did a pilot test for ten individuals to be sure that the network works. We looked for important people in the town so that if it works, they will speak for itself. The subscriber network began in 2003, but in 2002 we had this project to test run the network. Here I applied for EU money because it was possible for few municipalities, we award municipalities in Denmark and Nordjurs was one of them. A citizen of Nordjurs, I got this money, 1.5 million dkk to make the next step. The first step was from our pocket, but the second step was to cover 10 villages with 400 subscribers with EU money. However, before embarking on this project, the ten household projects had to be done. I sought guidance from professionals within the wireless networks in Denmark. They gave us guidance and it was expensive. The result was that we had to buy equipment in their name to buy equipment for 12000 including moms, they did not kill our spirits almost. I had to reconsider the whole thing. If wireless was that expensive, we would have gone for fibre with the money, but the end user in the villages would not have been able to pay. It would not be a common network and only the rich would afford it. So we began the experiment with the 10 households. We ended up with the situation where I thought was still expensive, which was 2000 dkk access. So I thought we could think like this 1000 for each house for the house and 1000Dkk for the part of the infrastructure and 100 dkk a month to pay for the ISP. Today, some of the networks have grown to reach the level where they do not pay the starting fee. Then they take between 60 and 100 dkk a month. Some have reduced the initial one time access fee to 6000 and 500 dkk in the beginning and then you pay 70 dkk a month. So the service is becoming cheaper. The goal of all the unions today is still to provide accessible and affordable infrastructure. The excess money is given to improve the infrastructure. If we pay anyone, the one is from a private firm to support us. For example, here in Grenaa the chairman after me Pernille is paid. Some of the supporters are paid in some degree and they are organized by the Djurslaand Broadband institute. They provide a specialized help and they are paid a certain amount of money for that and the private firm pays their employers. The volunteer and the employed people work together. The volunteer considers the professional as a help.

Question: **Is the Grenaa chairman not a volunteer as well?**
Answer: She is both a volunteer and a supporter as she is the director of the Djurslands Broadband Institute. The Djurslands Broadband Institute was designed for capacity building to teach people about how they can facilitate Broadband in their communities.

Question: **How did you attract more members?**
Answer: We started a campaign with the slogan of fast internet at a cheaper price, this was given to people, and interested people could sign in on paper or online. We collected more than 4000 free memberships. This made it possible to see that we would have the economy to raise the network.

Question: **Has ISPs moved in after the development of your network?**
Answer: Yes

Question: **Do you have price segmentation?**
Answer: No, they just pay for internet

Question: **Did you have topographical challenges when deploying the network?**

Answer: Yes, but we had to look for the high places. We had to look for masts, roof tops. In the case of the mast, we needed to have agreements with the owner and most of the masts were not useful anymore. So we offer them free access to the Internet for donating the mast. There are hundreds of mast involved where we provide free internet and then spreads the internet to the area. In some cases, we put up a mast. It is a bit expensive. In two to three hand full of places, we have masts. For a friend in the bovl community who had lots of tree he did not want. He wanted to cut it down, but he then realized the antenna could be mounted here. We also used the hills to set up repeaters. We did not know how, but we had to think of how to do it and we found the way to do it.

Question: **How did you plan the roll out?**

Answer: In the Nordjurs supported by EU. The money did aid in buying equipment. We had to pay for starting internet connectivity. We had to pay the starting fee for access to the fibre as well as the traffic. So the EU money for the rural area was distributed to the benefit of all the rural areas. The first connected villages had a cheaper economy. Then we had a common account, so EU supported all of Djursland

Question: **Would it have been possible to do it without the EU funds?**

Answer: Yes, actually we were not experienced with EU funding. We took the advice of people who supposedly knew about EU funding. However, we realized that they did not really know about it. We believe that when we were funded, we would wait for the money to come. When we talked to the EU office in Silkeborg, we were told that we should go ahead with the project and once the project is gone, the bill will be tabled by the EU who will refund 50% of the amount spent. And we did not know that earlier. So we had the 10 villages ready in groups and they expected 50 000 dkk for each of the villages and suddenly it became a lie. So I had to contact banks and they said no. I went outside to Aarhus and other places to meet the banks. The calculation was that the money each household will pay will make up half of it and the other half will come from the EU. Since we could not move as we could not get the money from the EU until after the project was done, then i went to the board of the municipality and told them the story. They agreed at the town hall that they will support it with municipal guarantee, so if the coop fails, the municipality would pay. But the administrators of the municipality were not sure if this would be allowed by the government. They sent the message to the ministry in Copenhagen. It took two years and by then the project had ended. Then we got an answer which declared that this is not allowed as it had to be done by the market. I had written to the ministry to prove that we had contacted the operators and ISPs and they were not interested because it was not commercially viable for them. But they insisted that it should be done on a commercial basis and the municipality should not provide the guarantees. PPP did not work when it came to the point it should work. We had to wait 2 years for a no. No one was willing to do it, and no one could do it and they still said no and all we wanted was for a guarantee and not money because EU would pay anyway as they had a contract with us. One day as I was on my way to the bank, I wondered what to do; I recalled that 3 people promised help. So I went to those individuals and I borrowed 2000 from the individual and from another 150 000 and from one individual 100000 and we had the level of money we needed guarantee for. We had the level of money to buy the connection out of Djursland and the equipment we started because the remaining money had to do with how many users we could amass to pay 2000 Dkk. In the beginning they could not pay the money over time. But later they are now able to make payment. One of the new networks does not have beginning fee anymore. Part of being a cell that, could be 1000 for equipment and 1000 for part of the cell, so we could figure out expansion, so we could figure out the needs of the nodes as well as the needs for access. The money we received from the cell helped us expand. That was the concept of the economy.

Question: **Did the EU finally pay?**
Answer: Yes, when everything was done, everything was paid, we had this extra money.

Question: **What were the phases you took in rolling out the project?**
Answer: yes. The first phase was the pilot project with the 10 users; From the town hall mast we extended connectivity. We had 5 users around the mast and 5 users around the sports hall. We got the connectivity from ADSL. At that moment, we know that the model works and we could extend it. We had the challenge of learning how to route traffic. We learnt by experience as we had a lot of downtime in some sections.

Question: **When did this stabilize?**
Answer: We had to learn by experience, we taught what it took to make the traffic stable. I had a hand on approach. We had this local board filled with people who wanted to decide or have influence, and then we had the volunteers who were technically minded. We had some volunteers who wanted to control as well if they were technical as well. So we had these troubles too. Actually, in the 16 man board, since the beginning and long into when we built the network, the members wanted influence. In some way or the other they managed to impress me that it was my responsibility to make everything happen. SO between every board meeting, which occurred between every forth night initially and later every month. They expected that between the meetings, I would make certain things happen in terms of solving problems. So we decide that Bjarke should do this and that. So I mobilized my 12 bovl group who were formed to support me. So when anything is expected of me, they helped me. The group had to grow as the board wanted many things to happen. So the practical group grew to 20 people between 2001 and 2004. It is important to understand how they work. These 20 were employed through the public system, so they were not all really volunteers. We had people from public works etc. So the arrangement would be something like, if the person works on with you for 6 months, after 6 months you have to start paying him or her. So we had to replace people after every 6 months, but in the practical sense, we had to extend their stay with us. I agreed to these arrangements and I had them for a time. Later we had a meeting with these people and told them we could not pay as we were not ready to pay wages. Later we had to pay only one of these external persons, from the project. This was because there were no jobs and for the social workers, they could gain work experience by working with us. We have a lot of IT support apprentices who work for us voluntarily. We had a problem with communication. We had the board, we had the technical actors, we had the central organs and the working groups. For some reason people did not know that the group working with me were not under any form of wages. That gave us some communication trouble which ended up disintegrating the unified network to the standalone networks. They thought that money they (various boards) were used to pay wages for the 20 people, whereas only one of them was paid 1/3 of the wages.

Question: **At the moment as the boards have disintegrated, do they coordinate in anyway or they are independent?**
Answer: They have informal coordination

Question: **How did you choose the board members?**
Answer: In Denmark, unions are common. We have a union law which means they should be democratic. There should be an annual meeting where everyone has a voice. Everyone had a right to put something on the agenda. So majority carries the vote. This is standard for unions in Denmark. Fascist organizations are not permitted in Denmark. If you do it another way then you have to form a firm. But the crucial thing is that one thing i did wrong was to decentralize the treasury. I was also at the cashiers meeting. I had just hired the cashier of Norre djurs as the co-worker in the center, the same person who ended up with 1/3 of the wages from the project. When I said, I think that we should put out bills to every household in Djursland from the

centre. She objected to it. She said it will not happen when she was around. There was silence in the room. Then one of the other cashiers she tried to put water on the conflict. We could save the portal if we go out with the bill and then we could hear what they have to say, and then we could decentralize collecting the money. The other cashiers found it interesting and the new employee, was satisfied and wanted to be involved in her own area. So I was in the minority with my idea of having a central pool for the money. This situation, of just 5 mins, made the whole difference. When you decentralize collecting money you decentralize the group. So anytime there is a conflict, the decentralized groups can split easily. There will always be a conflict. You can decentralize anything, the organizing, support, maintenance, project group but not the money. The moment the money is decentralized there will be no common organization. They had to stop sending the money to the centre. We bought the equipment based on where on where the money comes from and it was fortunate for us to do that. That made deployment cheaper. We at the centre could not connect to the customers as we did not have their addresses; their individual boards were much closer to them hence had to manage things. The advantage of a decentralized board is on the level of support, technic, and organization. On the level of decision and the economy, there should be a central board to decide. We needed 16 staff to be waged, but now it is difficult to employ people even at the networks. It is a lousy network compared to my dream of building a strong robust and sustainable network.

Question: **What role did the government really play in this project?**
Answer: I mean, when the network was a success, we had support from the political and administrative level. We were known to be trustworthy. However the political, business and administrator are not planning for the long run. They have other agendas. When it becomes hard, they are not there. That is why it is not good to build your abilities on this relationship. I was given the honor of being the cultural person of Nordjurs. I was honored with flowers and music. It had no bearing afterwards. It was correct of them to give me and my group this honor. But when it becomes difficult, they criticize. The municipality was interested. But from Copenhagen, the support was not there

Question: **Would you say there were regulations that helped you?**
Answer:. The free spectrum aspect is a regulation of 2.4 GHz exist in many countries and it helps

Question: **Do you pay tax from the subscriptions?**
Answer: Yes, but if you buy the tools to do a project, you can have the VAT refunded. But when you do the project, you have to pay the VAT, but get a refund for buying of the tools and the tools should be in working condition. We get refunds of VAT. But from subscription we pay 1/5 tax. We would have loved it to be VAT free. Even though we were a union, we had to be registered as firms. The state does not care if you don't get profit. We were not considered as a cultural organization so we were not free from tax.

Question: **Is there a competition from ISPs who saw your model and decided to compete?**
Answer: When we consider the economy of these possibilities, to have cheap Broadband you need a telephone contract from TDC. When you consider the economy, I do not think they can compete because they will run at a loss. They will have a good downlink, but less uplink, which is not good. We deliver much better upstream speed and you can do that with fibre. And fibre is very expensive. They can deliver in Grenaa center, but not here. If 45% of the household agree, they will put down the fibre and that is a challenge here. I do not think I will see it in my lifetime.

Question: **Why not WiMAX?**
Answer: It was very expensive. Skyline here in Denmark did not succeed. They need much

more equipment

Question: **Did you consider the role of CPEs and if the users could afford it?**

Answer: We based our solution of stationary computers. We used USB Wi-Fi boxes at the initial stage. Many had no laptops by then. USB meant they needed a driver. Many were not able to install their drivers; our people would have to send people out there. Later we had a network box that would not need the user to get a driver. So we customized a network box with no driver. We had a lot of trouble of double IP address with the automatic boxes. So we had had to develop an instruction manual for them.

Question **What is the way forward for rural areas in Djursland?**

Answer: They will not use Djurslands net. Maybe people in the cities like Grenaa of course will have other opportunities, but the people living in the rural areas do not have the other solutions in an affordable manner. There is no 3g network here; you have to go into the town.

Question: **Are the different networks operating in a different way?**

Answer: Yes, the still following the same concept.

Question: **What really triggered the conflict that broke the network?**

Answer: It is really strange. But it is a very important knowledge. I planned this network in a way that you have the network, you have the village. When I planned the network, we had extended it with Wi-Fi. We delivered 11mb bandwidth was redistributed to the users. If we had 10 to 20 users in the network, we could cope with the bandwidth, but we had to grow to be able to pay the bills. So we had fluctuations in traffic time. The quality of service was low and people felt bad because they had paid 2000 Dkk for them. We knew that the g standard in special issues and it was dangerous to buy the special issues; we had to wait for the stable standards. This would provide 54 MB bandwidth. I was not fearful of this. The moment it was standardized, we bought the equipment and then we had a very disturbing experience because then we realized that it was not providing the data rates we expected. We had fewer throughputs, so we had to put up the g standard and we had changed a lot of the links. It turned out that the 54MB can only be achieved on a short distance and not in the massive network we had. It is the same spectrum of 2.4 to 2.5, which implies that the frequencies are modulated higher. It meant we had to grow still on the b standard. So at this time, the temperature was rising, i started to go to the different ISPs to look for a solution, I wanted to get them to have a contract with us as a local service provider to the entire network and not as a customer, so we could have the opportunity to share their 2MB connection except cybercity. They agreed and we made a contract. The contract made us able to share the user connection of ADSL; we had agreed with local people where they lived in a place where they had access to ADSL. The problem with ADSL was that if you are out few km from the centre, the data rates reduce. The signals fade out 5km from the centre because the modulation can't stay alive. My idea was to get 2mb ADSL and an extra bandwidth from the ISP and blend it with the fibre. So we have 2mb from the ISP and supplement it with 2mb from the fibre. So that we could intermediary have high enough speed. So we set up 16 ADSL and travel around the network and told them that they will get it for free. This solved the problem temporarily as I waited for the H standard. Equipment for the H standard was hard to make, here we had another frequency so the modulation was better. The moment we put up on our long distance link, this was May 2004, and we set up the first equipment. It was very successful. It could measure more than 70MB at point to point. So we had to get rid of the DSL. So came the problem. The money that should have come from the monthly bill which would have paid for the equipment, the money was used for the agreement with the ISP in the short term. Its cost was 1100DKK per subscriber a month to the ISP. It was People did not understand why the money was going. So when the H standard showed that it was better, it showed that we could save 80000dkk a month to the ISP. People could not put the information together; even those actively involved said this cannot go on. So it came from my lacking ability to realize that we could not cope with g standard. If g standard had worked, then no problem would have occurred. We could not calculate the unknown. If this had not happened, then people would have said, this is not what we were promised, so it would have collapsed. So to me it is very important that people did not understand the decision.

Question: **Were the decisions, democratic?**
Answer: This was planned and the standard turned out to be worse. The decision on the ISP and H standard were not democratic, I had to take the initiative.

Appendix B.2 Developing Country Cases Interview Summaries

In this section, the interview summaries gathered from the Johannesburg Wireless User Group, Airjaldi owners of the Dharamsala Wireless Network and the Wireless Ghana Project.

Appendix B.2.1 Interview Summary with Johannesburg Wireless User Group (JAWUG)

Country:	South Africa
Person Interviewed:	Neil Govender
Designation of person Interviewed:	Current Chairman JAWUG
Mode of Interview	Face –to-Face Skype Interview
Duration:	45 Minutes

Question: **History of the coop?**
Answer: JAWUG started initially in 2001. The initiator was Kieran Murphy. It started from a community network with people living in the same street. They connected to each other via Wi-Fi to see how far they could push it. They started from the East of Johannesburg at the same time other similar smaller networks were popping up around Johannesburg. In 2006 there was an interconnection that connected the splintered Wi-Fi networks into one bigger network. This is the origin of JAWUG.

Question: **Background of the initiators?**
Answer: Kieran Murphy and Co were university students studying computer science. They wanted a platform to connect data on. At that time internet penetration in South Africa was very low and very costly. They wanted a platform to connect until they could collaborate their projects remotely.

Question: **Was the driver of the network just for education?**
Answer: The major driver was that they were gamers. They were looking for a gaming platform. This provided a low cost gaming platform for them. They further developed it into a learning and experimental network.

Question: **How was the transition from the splintered groups to JAWUG?**
Answer: It was informal. There was no committee or management body running it. Once in a while they held technical/admin meetings once or twice a month to decide what needs to happen. The network grew to a high user base and that was the point they realized that they needed a single management body to take the initiative further, hence the JAWUG management committee was formed. The management body consists of 6 elected officials.

Question: **Why Wi-Fi?**
Answer: In South Africa back then, if you had to do something private, the only alternative was Wi-Fi. The spectrum was free, hence the 2.4 to 5.8GH spectrum was free to exploit.

Question: **How did people get to join the network as it grew?**
Answer: In the early stage, the high cost and low speed of internet it did not fit in well with the gamer or geek culture. The data rates delivered on Wi-Fi were fast. There was a lot of excitement and the news spread by word of mouth.

Question: **Who manages this network?**

Answer: Volunteers work with the management board. The management board, of 6 persons, are elected during the AGM.

Question: **How do you solve technical problems with the network in areas?**

Answer: There is a management body that handles the organization - administration. Working under them is the JAWUG core team, which is the administration team. The administration team is broken up by areas. They manage the land site, they manage, equipment and manage connectivity as well manage the users living in that area

Question. **Are the committee members and volunteers rewarded in any form?**
Answer: They work free of charge .

Question. **How are new subscribers admitted into the network?**
Answer: We have a club and we have membership fees, the membership fees are not dependent on whether you are connected to the network or not. The membership fee is, a levy for the general network overload. If new members join they can connect the network in their area, once the membership fee is paid. However, there is no requirement to pay as such.

Question: **Is there any subscription for maintenance once connected to the network?**
Answer: No just the yearly membership fee

Question: **What is the number of subscribers currently using your network?**
Answer: 1500 - 2000 members are JAWUG subscribers. Others are in other wireless groups such as Pretoria, Cape Town, Durban and all the different areas. From time to time, depending on line of sight we interconnect to the other wireless networks. We are able to handle traffic from either side of the network and provide transfer through them.

Question: **Is this interconnection free?**
Answer: Yes, it is free, because some Internet Service Providers have donated free bandwidth to us to enable us to connect some other network that are within line of sight.

Question: **Was there any help from the government?**
Answer: No. But however, there was an approach to the government and the regulatory agency. However, due to bureaucracy and delays they decided not to go through that route. Decisions can be taken quickly and initiatives made easier if these were to be done without the help of Government.

Question: **My impression is that Johannesburg is a cosmopolitan area and the level of education is high, but I do not say about income levels and this played a role in the adoption of the network is this right?**
Answer: Yes, that is so. But there has been an attempt for the JAWUG and other wireless groups to get to the rural areas, but we faced the challenge of not getting much penetration. This is because the equipments are expensive; the level of education is low and to find people in the community that will be able to service the infrastructure is difficult. The people in rural areas have more basic needs than to be connected. This is why the rollout in rural areas has been very slow.

Question: **Would you say that it would be possible to have these community networks in rural areas, even though it will be adopted over time?**
Answer: It would be a good initiative. It is possible to roll out community networks in rural areas. It would help a lot of people and I think it would be adopted much quicker because if it is handled at the government level or in a broader level than just the community network, the adoption would be quite quick. The technology landscape in South Africa is changing and it is Broadband is still out of the reach of the average South African. The initiative will fix the gap perfectly.

Question: **Your network coverage extends to rural areas but you do not have users in rural**

areas

Answer: That is correct 100%

Question: **Did you at any point think of partnering with big telecom companies?**

Answer: South Africa at that time had a monopoly and they were not supportive. At the moment, we cannot traffic from one network transit to another telecom company's network. There is no much support, if anything; there is a push back from them on such initiatives.

Question: **What steps are you taking to combat these challenges?**

Answer: There is not much to do because government is in support of it. The telecom companies are backed by government regulations

Question: **Would you say that the project has reached its maturity stage or it is still growing?**

Answer: It is beginning to decline. Broadband price is falling and people are migrating to 3g, 4g etc. Our delivery speed is not as fast at the new networks. Slow throughput they opt for fixed lines.

Question: **Would this not be the point where community based networks could be developed in rural areas, just as the JAWUG initiative stood in the gap till the market grew, this would be the best time to push the services into rural areas?**

Answer: I agree 100%, but in the rural areas we have a very unique problem of cable theft and the telecoms companies are rolling out WiMAX, which in a way is unaffordable, which points to the fact that Wi-Fi might still be the way to penetrate into these areas.

Question: **Are there other stakeholders that helped JAWUG along the ways?**

Answer: ISP (direction on which way to go), the wireless Internet Service Providers Association (provided a regulatory framework for the free spectrum) Wireless application providers (protecting members by developing policies)

Question: **What are they you should have done differently?**

Answer **:** The organization should have been formalized much earlier to gain enough momentum and support and financial backing. The momentum would have been far better. At the moment, the personnel are volunteers, and you can only volunteer the time that you have. For a time the top management was not consistent. People would volunteer and leave and voluntarily and come back. We would formalize the management earlier and set out a clear strategy for development. Aside the membership fee, where they other ways in which the project was financed? There was, a lot of our hardware vendors saw a market for providing the hardware, so what they did was sell the hardware to the member as the hardware we needed and then give the organization a rebate of a certain percentage of all the hardware sold. Other bodies donated money to the organization as they saw the gap to advertise their business and other members with private businesses offered a cash injection into the organization.

Question: **Did you receive any form of loans?**

Answer: No

Question: **Would you say community based initiatives are expensive, if one were to look at the total costs?**

Answer: It is. At the moment high speed links are being deployed and these are expensive. There is also cost involved in upgrades when equipments are to be replaced.

Question: **Have there been problems with accountability or problems with decision making?**

Answer: Not really. But we have had such situations where groups do not agree. The way out has always been that we (the management) will handle the network in a way that we see fit. And then we will deal with the issue you raised, if we see fit. Afterwards, when the group finds out that their alternative idea is no sustainable they end up coming back. This because it is easier to work in numbers harnessing economics of scale, hence we can exploit that.

Question: **When the organizations return to join JAWUG, are they integrated into JAWUG or as partners**

Answer: They come back as part of JAWUG itself.

Question: **What data rate does your network provide?**
Answer: Earlier with Linksys theoretically 11mbps throughput could not be passed through it. But from the hills where the line of sight could be made 11 Mbps to theoretically maximum of 1GBps

Appendix B.2.2 Interview Summary with Airjaldi (They own the Dharamsala network)

Country:	India
Person Interviewed:	Current Chairman and Co-Founder of Airjaldi
Designation of person Interviewed:	Email and video supplement from Yahel Ben David, Founder Airjaldi
Mode of Interview:	Face -to-Face Skype Interview
Duration:	50 Minutes

Question: **Can you give me a brief history of Airjaldi?**
Answer: Airjaldi started as a social project, a personal mission by an Israeli (name Yahel Ben David), who had been living in Dharamsala for about 5 to 8 years. He had experience with building ISPs and had experience with radios. Gradually in India it was possible to use Wi-Fi for outdoor use for interconnecting buildings, but when they legalized it in January 2005, he had a small network built and ready to go ahead. He continued it for a while and grow it took it as a personal project for the betterment of children in orphanages there and school systems. Dhramsala is also the centre for the refugee Tibetans. This personal project continued till 2006 where I (Jim) and some others joined Yahel to organize a workshop. This workshop was an outgrowth of work that was first done in Europe between Berlin and London. They held workshop and international conferences one in Berlin, one in London and one in Djursland in Denmark about wireless networks and they invited people from various parts of the world, so they chose Dharamsala as the next conference venue so they could learn more about Yahel's network. So I got involved to help plan the conference and that was my first trip to India and spent about 3 weeks looking at India and trying to understand how they came about with the low cost structure that would provide good Internet to the people. So we brought in another person, Michael Ginguld who had been in Dharamsala previously and was a friend of Yahel. So he came, we programmed, made our plans for 2009, organized how to make the network a commercial entity and to register it as a private company in India called rural Broadband. So, since 2009, we have been proceeding on that commercial thing, but Yahel went to grad school in Berkely UC Berkerly in computer science back in 2008. Michael leads the management team in Delhi, so we have been gradually growing it since then.

Question: **The initial purpose for developing the wireless network was to develop rural wireless networks , has the purpose changed?**
Answer: It is still the same. Rural areas are chosen because there is a big need for Broadband from a commercial point of view that translates into a good opportunity. Secondly, we were

familiar with the technology for building networks using Wi-Fi with directional antennas. In rural areas that work fine, but in cities, there are issues with too much congestion, with interference and so forth. We focus on rural areas, but we also cover the intermediate areas, where there are schools, there are bus systems to the towns, there is limited internet from the outskirts of the town, so we are serving them as well, and people here will pay for it,

Question: **Can you give me a brief description of the Dharamsala rural area?**
Answer: It is an area with low population density, there are village lots of villages from 500 to 1000 people and 1km away there is another 500 to 1000 people, there are farms with fields in between. In the plain areas they grow wheat, in the hilly areas they grow smaller fields but they have animals. There are roads , not to every village, the road system is there and the electricity system is widespread but not running all the time, there is a bus service to the towns. In rural India varies in different states, there are states where there are poor states and there are states that are more prosperous. We are not in the poorest state. We are in the medium or prosperous state. They may be rural but net the poorest of the poor.

Question: **Are you receiving any help from the Government of India?**
Answer: No

Question: **How is AirJaldi funded?**
Answer: I provided some additional capital and I was added to the management team. We are a commercial entity and we have to provide services that people want and are willing to pay for. We have many schools as customers. Both Private and public school pays for books, so the proposition to the school is that they pay 1 dollar per term for their student to access the internet on the computer

Question: **How was your need assessment done to understand what people will pay for, did you conduct a research?**
Answer: No. We just went in there. This is because it is a commercial entity

Question: **Were there other stakeholders that helped you in starting up?**
Answer: Yes, the private school system which consisted of 13000 schools across India, they had ICT teachers, so that was helpful. Also, people from the Western part of the world came to help.

Question: **What do you think is motivating the People of Dharamsala to subscribe to your service?**
Answer: It is the same reason people in California subscribe or in Europe subscribe to the internet, that is connecting with friends and family, looking upon information that might help them with their studies or with school and there is entertainment. Entertainment is always a big thing, so people they pay for these services, they watch movies and they watch movies with their friends. We also have a Facebook page which acts as a bridge to all apart from that it is communications to friends and family.

Question: **Can you tell me about the other sister networks in India are they still in operation?**
Answer: Yes, we have 5 networks in 4 states in India. We use the networks to expand, we have used our business strategy of the anchor tenant or anchor customer. In one place there is a bank doing rural banking, they needed access and the mountain section of India was very limited in access so we took a contract to deliver internet to the very mountainous area, it was difficult, but we did it, but we knew that there was a small town close by that was a tourist place in India which is popular in India, so we thought we would see some good private schools as well as see some business of our own which we have been. Another anchor customer was an individual engaged in BPO, business process outsourcing, but he wanted a rural BPO and he said if he had internet access there, then he would buy it and he now has 450 seats for people working there. There are other BPOs in India, but they

handle the role setting, but the advantage to is that, it is a better working environment for the people and there is less and there is a stable workforce in a cleaner environment. The place is really a small town. The rural banking company came back to us 2 years later and the network was successful, so they expanded it to 50 sites and we are now in the process of doing one of them in south India.

Question: **Have you had an experience of developing a network in any part of India that was not successful?**

Answer: No

Question: **What were the factors that you considered before going into an area to develop a network?**

Answer: We assess the economic activities of the area. We use Google earth to check pictures of the area, and having been in other places in India, we have some idea of what is there. Then we send a team to do an on-site survey of the villages to find out if there is an economic base. Are people driving some cars, some taxis, bicycles, motorbikes? If there are no motorbikes then people do not make some money.

Question: **Do you consider the population of the village as well?**.

Answer: Yes, the fact that the villages are crowded are not far apart as mentioned earlier, about maximum 500 km apart but there is plenty of demand and it is our mission to supply that demand

Question: **Do you have the same factors for providing your services in the cities as well as rural areas?**

Answer: It is more difficult and expensive in rural areas, but in return there is less competition for our services. It is needed more. In the rural areas, we make all our equipments to be solar powered so we are not dependent on the electric grid which is quite unreliable.

Question: **And the wireless technology is Wi-Fi?**

Answer: That is correct

Question: **I believe you adopt it because of the topography the mountains?**

Answer: Yes. It is very inexpensive and very available

Question: **The Dharamsala wireless I hear it is the largest Wi-Fi network in the world?**

Answer: It is probably not ,but quite a good size

Question: **Why was this network necessary?**

Answer: It is the demand, people want to talk, people want to send email. Michael had a personal connection with the area so it was happenstance. Aside that western tourist also wants the internet. It was an economic disadvantaged for a service in that area.

Question: **Question: Why not Wimax?**

Answer: The equipment was more expensive, it acquired, access to license spectrum. It would result in huge costs and small companies cannot use it. A company has to close to the mobile operator, we could not use it.

Question: **Did you go through some governmental processes in the setting up the network?**

Answer: We are a registered private company in India, so we have to conform to all the laws and there is sales tax and service tax, which requires some book keeping. Before becoming a commercial ISP, you must have a license; we operate as a sub of a company that has a license because licenses are expensive. Recently they have lowered the price of the license so we will get our own license. We have had some investigations, but one of our managers in Delhi is a lawyer, so he is quite knowledgeable about the regulations. So he helped us through the process. Here in India you need an id to carry out a transaction with us as that is the government regulation. This ID is recorded and placed in our record.

Question: **How was the relationship with the telecom companies when you started the business?**
Answer: Largely we were invisible to them as we were so much smaller; however, we are now customers of theirs. We buy from them wholesale internet access, we distribute it through our infrastructure and resale it at retail. This is our business model. We are customers of the telcos.

Question: **If you were to invest in the poorest of the poor in India, what incentives would you expect from the government of India?**
Answer: The government has these incentives like universal access funds, etc., but we are really far too small to really use that

Question: **Do you think, Airjaldi would in the future develop a business model that would push internet supply into core rural areas?**
Answer: Yes, but now we are providing fixed wireless internet services, i.e. internet access to buildings, such as schools, rural BPOs. As we grow and as we reach individuals, then we will expect some of them to have smart phones, in that sense, a prepaid model would work.

Question: **Are there competing Broadband networks now and is it affecting your patronage?**
Answer: No, I cannot say that now because the internet is only available in the cities, and that happens in several forms, including DSL technology over wires, including Wimax, including dense Wi-Fi in cities and 3G based mobile service. All these you do not find in rural areas, if it were so, we would not be in business. For the network operators in rural areas, the 3Gs drop and the 2Gs signal drop sometimes to nothing.

Question: **So in Dhramsala, there is no competitor?**
Answer: In the city, yes, but we provide services in the greater Dharamsala area. There is an area called.... valley. The area stretches for 60 km and 30 km across. We have a lot of areas here. We know that with time, the other services will come in, but we are sure that the schools and businesses would still want speed, more reliable service, a school may want 2mbit, 4mbit to enable education, we can charge 50 dollars a month for 2mbits or 100 dollars a month for 4mbits, they can get that because they have several hundred students and teachers and so forth, it is very difficult for a mobile to supply, first because it eats a lot of bandwidth and second of all the businesses need more dedicated and secure services but the mobile operator would not provide that. Hence we will co-exist with the new competition.

Question: **What data rate do you provide to residential building and what data rate do you provide to commercial building?**
Answer: Some customers want 256kbps , 512kbps, 1, 4 Mbps

Question: **What payment model are you using?**
Answer: Monthly Post paid

Question: **How has topography affected the development of your network?**
Answer: The hills help us cover a large area. In other areas, we use buildings to put up our antennas, we use telecom towers too. Some areas have a lot of trees, what is the number of customers you have, no customer in urban areas, and more in rural areas, small towns. We have been doubling every year for the last 3 years.

Question: **What is current subscriber strength?**
Answer: No customer in urban areas, and more in rural areas, small towns. We have been doubling every year for the last 3 years.

Appendix B.2.3 Interview Summary with the Wireless Ghana Project

Country:	Ghana
Person Interviewed:	Anonymous
Designation of person Interviewed:	A Personnel of Wireless Ghana Project
Mode of Interview:	Face –to-Face Skype Interview
Duration:	I hour, 5 mins

Question: **The impression I had from your website was that it was an ISP, but recently i realized that you were not an ISP?**

Answer: No, not really, but we had the vision of being an ISP, unfortunately we had challenges as a result of sustainability

Question: **Is the network still functional?**

Answer: No, Teledata ICT came in as a competitor and as we were suffering from sustainability issues we could not compete. Clients were not paying their bills regularly?

Question: **Can you tell me the history of your project, what was the idea behind the project?**

Answer: John Atkinson initiated the project; he was a Peace Corps volunteer from the US sent to a centre in Apredie in the eastern part of Ghana to help the centre in the ICT section. The centre had an ICT section, a nursery and a library which provided support to the community. He came to support us and help the community, when he came and he thought it wise to use the redundant VSAT we had.

Question: **Who gave you the VSAT?**

Answer: The schools around that was benefitting from it. So he led us to do a research from where the centre was towards the beginning of the town Akwapim north is an area that where we have the centre is the last town on the ridge. The research involved meeting offices, organizations and churches along the town to sell our idea of redistributing bandwidth to them so that they could share the cost of running the VSAT.

Question: **The VSAT, was it the school that John was posted to?**

Answer: Yes, it was a community centre to serve the whole ridge. But it was positioned in one town so that the neighbouring schools in the towns can use it. The schools did not have computer labs so the used the centre for their studies. They also used the centre as a library for the students to read. This was in 2006. We decided to share the bandwidth so that the cost we bear as a centre could be spread across so that we could sustain the library. We did research on the client to find out those who are interested and those that are not interested. We also tried to convince those who are not interested because at that time there was no internet at the ridge, the modems and masts were not here. We thought it wise that we could adopt the wireless solution

Question: **How did you convince them?**

Answer: We told them that we had a internet that will benefit them if they subscribe to us it will help them in sending emails for easy transactions and cut down their cost of making telephone calls. We told them that globalization was setting in, so they had to adopt it. Most of them showed interest, however, they thought of the cost. Some were even of the opinion that the service should be free. We told them that is was impossible to give out the service free as the service infrastructure was also funded by another organization. Hence paying something would show a sense of gratitude for the organization's effort as well as the fact that the project can be sustained. They were all interested. Wireless Ghana was the first rural wireless project that was established in Ghana before

TeledataICT came into the picture here.

Question: **How did John identify those he wanted to work with?**

Answer: We were already IT workers in the centre, so we were his first port of call. We thought it wise that it was a nice idea. As a peace corps volunteer if they initiate a project, it gives credit to them and to the organization and the organization sometimes help .

Question: **At the last ridge of Akuapim, what is the socioeconomic situation?**

Answer: They are not that educated, they are farmers, there are few graduates, but live in the city and in other parts of the region. The farmer makes about 100 Ghana Cedis a day in a good day. They cultivate maize and sometimes palm nut. There is electricity and water supply to the homes and bore holes as well to those who don't have access to water. It is not the poorest of the poor village. There are churches, organizations, including water aid and other NGOs. Water aid was our customer as our service helped them. There are micro finance and rural banks and Ghana Commercial Bank (GCB). GCB uses VSAT. We could not convince the rural bank because after the test we did with them, our bandwidth could not sustain their operations. There are hotels. Restaurants district assembly offices, small businesses. etc.,

Question: **Who provided bandwidth?**

Answer: NCS, now they have a new name. After NCS we could not pay the bill so we went for TeledataICT. They saw the market potential and decided to invest. Their service was expensive; they could not sustain it after one year. The district assembly, where potential subscribers, but due to bureaucracy and they could not pull through, same with the district education. The hotels did not have many customers; hence they were not in need for much bandwidth Hence teledata could not handle it.

Question: **So after you convinced the people how then did you roll out the network?**

Answer: The network roll out involved us meeting the people from door to door, if they accept the service we give them a pro formal including the hardware the client had to buy and the accessories needed for access. When the client pays then we do the installation. What we did was to use a an old personal Computer (PC) with no hard disk, but with a workable Compact disc (CD) rum, in this case one could just boot the PC with the CD rom, this makes booting faster. The CD itself was the client billing system given to the client. The ram size had to be higher. We had the software from the USA who customized the software. The company's name was community wireless. Initially the software was not stable, new versions were being released every week. The problem with the unstable software was that anytime there was power fluctuation of the electricity went off, then it had to reboot again leading to loss of data the user was working with. Usually we had to take care or some means of transportation to the client to hello reboot. The billing, of course, was not affected. Finally, they got the stable software, once the light goes off and returns the software reboots automatically and the users work is saved. The devices the client has to buy was ups, directional antenna, this depended to the spot. We then point your antenna to our access point. we gave them the system unit free. The first test that we ran was at a church which was on a hill. From the church there was a line of sight to our centre, the church had a high tower beside it. so we opted for using the directional antennas to connect the two spots and then used an omnidirectional antenna at the church to serve the neighbours who were interested clients living by the church. So we had two access points. We provided the omnidirectional antenna and the directional antenna to our end.

Question: **Who paid for the free accessories?**

Answer: It was the centre that was supporting, the centre got funding from Cblit, and they have an office in the United States and in Ghana. The one who brought the centre was working with the World Bank, so she brought the centre to support the community. It was cblit that set up our centre. Our centres name is Apredie resource centre.

Question: **How much were they paying to access the service?**
Answer: They paid 150 Ghana cedis monthly on the average if they lived close to the centre. Those who lived far away paid much more because the equipment needed to transmit the signal farther away was expensive. Hence the monthly cost of transmission was also high. On the average, they paid 310 Ghana Cedis (mostly for organizations). For organizations and people with more computers hooked to the network, they paid 50 Ghana Cedis per node. In such cases, a rebate of one node free was offered. For access, there was no fee; all they had to do was to buy the devices stated on the invoice. But in general, we charged them based on the bandwidth there was no standard pricing, data rate fluctuated between 128 and 512kbps. It was useful for those running internet cafes. However, we were running a deficit as the income was less than the expenditure, hence it was difficult to go for a higher bandwidth and the bandwidth requirements was rising by the day.

Question: **Would one be right in saying that some people were not happy about the fact that there was inequality in subscription fees?**
Answer: No, not exactly. We alone knew the bill sent to each person. We explained to them that the farther they were, the more costly the transmission equipment. The subscription grew as a result of most using the service for downloading and streaming Youtube.

Question: **How much bandwidth did you buy from NCS and later teledata?**
Answer:. 1mb

Question: **How much did that cost?**
Answer: 407 Dollar a month

Question: **How did the people in these areas get to know about Youtube etc?**
Answer: The centre we had was a hub for ICT for the Akuapim ridge people. People came in to check their mails after work in the evenings. It was like a telecentre. It was used for ICT trainings and a lot of other ICT related activities. It was the only centre with internet access. The community centre was a school, so it was in the evening after school that it was transformed into a community centre. Some were asking how the service could be connected to their home

Question: **Was it before John came or after John came?**
Answer: It was before John came. Actually John was around while people were coming. We did the research first with John that was how people got to ask if it could be extended to their home

Question: **Does this mean the demand was there before John came?**
Answer: Not really, the people never came to ask because they did not know it would be possible, it was after John came with the idea that the people got the idea. John actually planned the project before coming. So we provided the support.

Question: **When John brought the idea, how was this idea received by the centre admin?**
Answer: It was not easily accepted because the admin doubted the possibility of the network?

Question: **How did he convince the management of the centre?**
Answer: He tried several devices, he bought the devices. He shipped in the test devices to run the test before we met the client. We had an uphill task to also convince the clients as well as they are is mountainous and there was no visible line of sight

Question: **Did you have GSM at that time?**

Answer: Yes, but the signal was poor

Question: **Is it good now?**
Answer: Yes, but not for all the networks, it is mostly 2 g and some spots have 3g

Question: **Did you approach the private sector in the community to help fund the project?**
Answer: No, because CBlit did not want us to do that. Secondly, they did not want to deviate from their area of core competence which was not the extension of wireless ICT.

Question: **Where did the funding come from?**
Answer: It came from the clients

Question: **You did not receive any external funding?**
Answer: We received some money from the World Bank but it was for a case study on the project and not to fund the project If it was meant for funding the project ,maybe we would have expanded.

Question: **So no money went for the project?**
Answer: No. if we had funding, we would have increased our bandwidth because we had a heavy load on the network and we promised them that we will expand the infrastructure and get more bandwidth. Unfortunately as we had no funds, this could not be done. This led to user dissatisfaction and we lost customers. Teledata who was our new bandwidth provider saw this lapse and decided to supply was this project handled by the ICT department and not the whole NGO.

Question: **Which department handled the project?**
Answer: It was handled by John and the IT department. Money that came from the clients was paid into the centres account at the Apredie community bank

Question: **What was the purpose of the case study conducted by the World Bank?**
Answer: They were interested in the project and wanted to support it, but they needed the case study to know how best we were running the project

Question: **What of the district assembly, ministry, etc., did they help in any way?**
Answer: Cblit came in to run ICT training programmes for the area, the governments idea was to build a rural ICT hub for the country to extend telecentres. Hence UNDP was brought in to train the people. I have no idea about the funding; we trained the community schools and basic school leavers and gave them certificates. But the hub was not built. John went to USA to do a presentation on wireless Ghana

Question: **We have village structures in Africa, what was the role of the village in this project, is it not possible for the village to run such a network it was, we tried that as the system was about to collapse?**

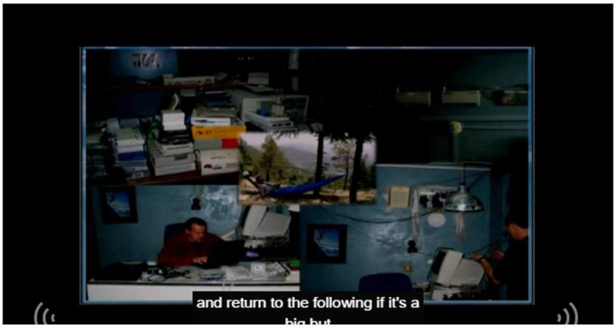
Answer: The village decided to help because we consulted with the chief. The chief wanted to take the centre as a community project and look for funding to sustain it. But the CBlit the mother company decided against it. The same case happened in koforidua but the mother company did not want to be involved on a larger scale. This led to an end of the wireless Ghana project

Question: **What is the motivation of the NGO to go into ICT and rural development, what is their core competence?**
Answer: The idea they had was to build community centres and to have libraries and educate the school children in reading habits to bridge the digital divide between the children in the city and children in the village. So the wireless Ghana project was out of context to the scope of their operations

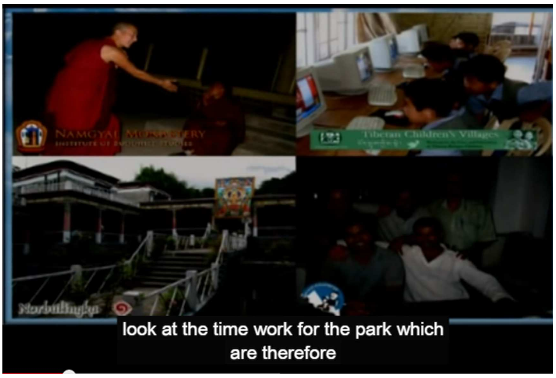
Appendix C. Transcribed Video from Yahel Ben David, Founder of AirJaldi

Title of the Talk: How can we accelerate the reach of internet services to rural areas of the world I spent the 80s and 90s, designing and building internet service providers and data centres across the globe. Then in 1998, I got a call from a friend who was working with the Tibetan Government in Dharamsala, a little small town in the Indian Himalayas.

He asked for my help in Internet connectivity and He said there was great tracking in the area. So I came over for a short visit and ended up staying for 10 years. I do not know if I could climb the Himalayas peak today, as I have gained a little bit of weight. It was fun when I could. I sold my shares in the company, I co-founded in the USA and returned to Dharamsala, my work focus was Internet connectivity to all communities. This is still the core focus of my work today and in the last three years from here in Berkeley. This old photo, I do not know, if you remember the days of coaxial internet hubs and 1200 pound modems that used to get burnt every often, that is why we have such a big pile as seen in the figure below.



At a time there were many local organizations in Dharamsla that already had computers. They were desperate for Internet Access. The only one that could afford a very expensive had a slow internet connection. Many of these NGOs worked in collaboration and they were willing to share the costly links of the satellite (VSAT).



But they were located farther apart from each other, therefore sending floppy discs on motorcycle became their dominant means of exchanging information. I then start searching for solutions to connect the organization, I also searched for bandwidth from very far away cities. It quickly became clear that the problem was not unique to Dharamsala and not unique to rural India. Hence, whatever solution I realize will serve a much bigger population. This was a motivation to work further.

Let us go a bit into the history of this technology. In those days if you landed in India with a laptop you were a criminal. Most laptops already back then had Wi-Fi chips already embedded in them, Wi-Fi radios and using any radio waves without a license were illegal in India. The possession of such an equipment could get you in trouble and get your laptop confiscated. This is because the use of the radio waves was reserved for large corporations that could pay the license fees. Fortunately, this is no longer the case, Wi-Fi into radios and in laptops has been visible for about 10 years now virtually in every computing device. Policy makers had to allow this and allow people to use them freely. The advantage of Wi-Fi is not in the technology itself, but it is because it has been deregulated quickly all over the world. Deregulated means that we can use it without a license. This is a very big shift because the deregulation of Wi-Fi is driving innovation, which in turn drives adaptation, which in turn drives prices down, making the technology affordable and ubiquitous everywhere.

Early in 2005, India finally deregulated the use of Wi-Fi, and for me, this what created Airjaldi. This is what symbolizes the start of Airjaldi. For the first time, we were free ourselves and experiment with the wireless technology without dependency on the telephone companies and large corporations. I therefore began to set up the improvised wireless devices on the roofs of the organizations in Dharamsala

I named the signal Air Jaldi. Air Jaldi in Hindi means heart, this was to suggest that the days of painfully speeds are over. Within a few days of Wi-Fi deregulation, we had a small network of interconnected organizations all sharing a satellite link to the internet. This network has been growing ever since. We have learnt to use Wi-Fi to make very long wireless distance links. The same low cost silicon chips that are embedded in the home routers that you see is connected to directional antennas and with some innovative software modifications allowed us to link stations hundreds of kilometers away and with pretty fast bandwidth, faster than what some Broadband connections even allow today.I then started ordering piles of these home routers and rip them apart to build the outdoor units. In the top centre photo, you can see my wife she is talking with an expensive IP phone to her sister in Israel and over a network that we build ourselves. This was a very good way to test the network, if she cannot make the phone call then we had to fix something. Let us jump ahead six years- at the present. We have successfully installed 100s of wire links. We have thousands of happy users and we are growing fast. Since I left India, things are growing much faster, we now have a presence in multiple states in India and network academies and it is really wonderful work that the team on the ground are doing. They have learnt to overcome complex operational challenges to find solutions and demonstrate sustainable business models. But much more important, our works inspire many rural entrepreneurs, including global competitors, they all follow our path to serve the local communities and we are very proud of that. The lessons from Airjaldi can be expanded into a global scale. On a global scale, we need to think of solutions without radio towers, identify ideal business models and come up with simplified network management. These are challenges that could hamper the diffusion of our solution on a global scale. We have also experienced line of sight problems. High towers are needed. Hence natural towers like the mountains were used. This leads to much higher coverage.

The challenge here is that there is no power on mountain tops. However, solar power was used. In some countries where the power situation is bad, renewable energy is needed. Hindu temples on the mountain tops were also used. The challenge here, however, was that one cannot serve many users using these long range connections. We needed to make software changes to the existing equipment in order to solve that. To solve the second challenge, a policy approach is needed. The policy will lead to a decoupling of wireless infrastructure providers from the wireless service provider. The rural operators should only operate a network of smart wireless pipes. The pipes will link subscribers to existing wireless internet service providers and subscribers will be able to choose their ISP. The wireless operator will manage the infrastructure and they become internet neutral and does not require any licenses. They service provider will not compete with the bandwidth provider, but become valuable business partners to them.

Appendix D. Magnolia Road Internet Coop (data)

Data gathered from MRIC was mostly via e-mail and Linkedin mail. More data was gathered from the Colorado Broadband map.

Appendix D.1 MRIC Event Diary Outline Provided By Greg Ching

Date	**Event**
29 Oct 2003	New service number added. You can now call 720 210 1969 for service. Of course the email, support@mric.net is still available.
25 Oct 2003	3 New POPs under construction! We are currently building 2 new POPs on Sugarloaf to serve the middle level of Sugarloaf and to finish the end to end linking of the network. We are also building a lower Thorodin to serve Subscribers there.
08 Apr 2003	MRIC added to web site of leading Colorado WISPs.
17 Mar 2003	MRIC stays on-line during blizzard of 2003! Even state Representative Tom Plant conducted legislative business by Internet as 5 to 6 feet of snow buried residents.
10 Mar 2003	With the addition of the 8.3 mile link to Upper Sugarloaf, the backbone changeout is nearly complete
31 Dec 2002	Completed move off Yahoo! Groups - all MRIC lists hosted on MRIC servers.
30 Dec 2002	Trial of public safety audio streaming begins.
29 Dec 2002	Lancelink (local speed test) upgraded to write process ID.
26 Dec 2002	Conversations with the Colorado Internet Cooperative begin regarding closer cooperation.
15 Dec 2002	Construction begins on upper Sugarloaf site on a relay point to join lower Sugarloaf (Tall Timbers) to the rest of the MRIC backbone

20 Nov 2002	Replacement of the network backbone with higher speed Trango 5.8Ghz gear begins
18 Oct 2002	MRIC mentioned in Front Range Tech Business Journal.
04 Oct 2002	A WiPOP is built on upper Sugarloaf mountain providing service to Upper Sugarloaf and Lower Magnolia road.
16 Aug 2002	Magnolia Road and Sugarloaf Internet Cooperatives mentioned in FOXNews.com article.
08 Aug 2002	MRIC.NET domain registered.
07 Aug 2002	Rollinsville residents start asking for repeater.
07 Aug 2002	MRTG (traffic stats) graphs added to subscriber area.
01 Aug 2002	The network is reconfigured to provide failover between our two upstream providers across the mesh.
27 Jul 2002	Directional antenna is installed at the Lazy Z NOC. The wireless mesh linking our two NOCs via Thorodin is complete.
14 Jul 2002	Mt. Thorodin repeater built and brought on line. Many thanks to our volunteer repeater builders. For the story in pictures see here.
28 Jun 2002	MRIC appears in the Boulder County Business Report
15 Jun 2002	Three more installs done. Tim and Peggy Gorman kindly contribute $300 seed capital, declining loan repayments. Thank you!
14 Jun 2002	6 more 24-dBi antennas arrive along with 1 repeater amp. Twelve more female pigtail cables arrive, too.
12 Jun 2002	Jill & Greg Nazimek become first Coal Creek customer.
11 Jun 2002	Don Roper becomes our first summer resident subscriber by paying 3 months in

	advance.
02 Jun 2002	Bob Bows donates 486 PC to MRIC for use in our NOC. Mike Lewinski plans to remove Windows and install BSD for use in our NOC. Thank you, Bob!
02 Jun 2002	Joel Ehrlich becomes first MRIC subscriber to report canceling his DirecPC subscription. It took 45 minutes.
01 Jun 2002	ISDN backup now in place for automatic failover. Paid service begins with subscribers having until June 10th to get agreements signed and first quarter's payments made.
31 May 2002	Out of 39 trial subscribers, 22 active users. Remaining 17 still completing installations.
30 May 2002	50% attainment of $15,000 seed capital goal via $300 loans.
29 May 2002	MRIC solves RG-1100 configuration problems. New owners of Ethernet Converter and RG-1100 advised to let MRIC configure.
28 May 2002	20 more PCMCIA wireless cards arrive.
27 May 2002	More installs completed bringing total completed installs to 20. First Lazy Z repeater install tests at 1.2 to 1.3 Mbps downloads! First 1+ Mbps downloads reported onwww.dslreports.com/archive validates MRIC philosophy of uncapped service - if no one else is using the bandwidth you are welcome to it! For $50/mo this is a tremendous bargain...even better when rates are lowered.
26 May 2002	Winiger Ridge repeater upgraded. Lazy Z repeater installed with Rockynet Frame Relay feeding it.
25 May 2002	Last formal install work party...new installs by arrangement only.
24 May 2002	Richard Garcia becomes first paid subscriber, paying 3 months in advance. More checks coming in the mail!
20 May 2002	Four more subscribers add RG-1100 (wireless LAN) capabilities to their home; five known RG-1100s are being deployed.

18 May 2002	More subscriber installs completed bringing the active trial usage to 18 subscribers (out of 32 signed up for trial). About 80 potential subscribers are on waiting list.
17 May 2002	20 more Avaya PCMCIA Gold cards ordered.
16 May 2002	Jay Sklar becomes first MRIC Wondervu subscriber!
15 May 2002	Good results from preliminary Mt. Thorodin repeater sites.
13 May 2002	200m AirComm cable, 20 N male connectors, 5 PCMCIA Gold cards, 5 Ethernet converters, 5 RG-1100s w/USB client & Gold PCMCIA cards, 10 female pigtails, 6 HyperGain 24-dBi grid antennas ordered.
12 May 2002	More subscriber installations completed bringing the total of network users to 16.
11 May 2002	More subscriber installs completed.
07 May 2002	10 more PCI adapters ordered.
06 May 2002	Another 100m of cables and 40 more cable connectors arrive.
05 May 2002	Winiger Ridge #1 repeater antenna upgraded.
04 May 2002	More subscriber antenna installs completed. Over 50% of trial subscribers completed installation and actively using network.
03 May 2002	MRIC mentioned in Boulder County Business Report column.
02 May 2002	Presentation at PUMA Open House at hosts LYnda and Clark Chapman's home. Thanks to Jay Biddle, Scott Bogart, Greg Ching, Rick Cobb, and Dan Metzger for helping to set up.
02 May 2002	Ribbon-cutting photo and article in the Mountain Ear.
27 Apr 2002	Twin Sisters repeater now up and running. Thanks go to George Watson, Hans Rohner, Mike Morrisey and John Colton.

24 Apr 2002	First T1 line added to MRIC network! ISDN line used as backup.
22 Apr 2002	At least 30 people brave winds on a sunny day to witness the MRIC ribbon-cutting. Special guest Paul Farnan from Congressman Mark Udall's office attended. Lots of shrimp, pate, and wine!
20 Apr 2002	Braving rain and snow, two teams installed a few more antennas. In one very difficult (sunken) location, an amplifier was required to get a good signal 1.4 miles away. In another situation 2.12 miles from a repeater, a very strong signal was received without any amplification. In the latter case, over 90% of the packets transferred were at 11 Mbps during "white-out" snow conditions! Both locations verified by laptops surfing the web.
20 Apr 2002	Winiger Ridge tower goes live at 9:45 AM.
17 Apr 2002	Twin Sisters repeater installed by John Colton, George Watson, Hans Rohner, Mary Jo Brodzik, Rick Cobb, John Kauzlaric, and Greg Ching. Six subscriber antennas assembled as well.
14 Apr 2002	Three more subscriber antennas installed. At least five other sites are ready (i.e. no external antenna needed). Approximately 40% of the trial subscribers are ready for service, or very close to getting service.
13 Apr 2002	ORiNOCO install clinic and first subscriber antenna install at the Cowart residence.
05 Apr 2002	First Winiger Ridge repeater installed by John Colton, George Watson, Ric Turley, Mike Morrissey, and Greg Ching.
02 Apr 2002	Network modem card bulk order deliveries begin.
14 Mar 2002	Both RockyNet and Fortis backhaul committed for April trial. ionSKY proposal also received.
12 Mar 2002	Taggart & Associates reports insurance success!
10 Mar 2002	Board decides to order Fortis connection (as earlier attempt stalled).

10 Mar 2002	More testing on second Lazy Z repeater despite high winds.
07 Mar 2002	Board meeting to review subscriber agreement draft.
07 Mar 2002	Negotiations continue with ionSKY. RockyNet order waiting for Qwest local loop date.
07 Mar 2002	Article in Mountain Ear on April MRIC trial.
05 Mar 2002	30 ORiNOCO cards @ $79.95 ordered from HyperLink Technologies.
04 Mar 2002	Article in Daily Camera on Nederland area WISPs.
02 Mar 2002	Upcoming trial press release issued.
01 Mar 2002	Board meeting to discuss ionSKY and RockyNet backhaul options. Decision made to order Frame Relay from RockyNet and T1-equivalent from ionSKY. Banc One signature forms signed. Treasurer Allen Schmitt-Gordon receives 10 seed capital checks for deposit.
01 Mar 2002	MRIC meets with ionSKY to discuss possible synergies.
28 Feb 2002	George Watson interviewed by Daily Camera reporter.
12 Feb 2002	Pablo Sanchez and Paul Kolesnikoff resign from MRIC board after 6 months of service. Thanks, guys! New board members Ric Turley and Alan Dunwell appointed until general elections.
08 Feb 2002	Taggart & Associates receives new AIG insurance application.
07 Feb 2002	Alan Dunwell becomes the first person to write a $300 seed capital loan to MRIC even though he will not be ready for the initial trial! He is joined by over a half dozen lenders who agreed to no-interest MRIC promissory notes. Thanks again to our demo hosts Jim and Todd Cowart!
04 Feb 2002	An order for 3 roof mounts for repeater locations was placed today, along with an order for the necessary tower hardware (mast clamps). They are 4.5' tall with a good base, should be able to take the winds. There will be about 3 feet of mast out

	the top with a pair of dishes, one horizontal, one vertical.
02 Feb 2002	Board meeting at Rick Cobb's house. Decision made to start the trial on April 1st (no fooling!). George Watson has found a way to modify ORiNOCO AP-1000 into repeater station wireless routers, saving MRIC $300 per repeater station. Pablo Sanchez will place the order for the T1 line this week.
02 Feb 2002	Groundhog's Day testing proved successful. We were able to surf the net from the Cowart's residence to George Watson's test repeater. We got a 17 dB, 5 Mb/s signal over a 1.35 mile distance which should prove more than sufficient for the PUMA demo. Unfortunately, equipment failure prevented us from confirming if the BRODZK<->CARDER link will work. Since we don't need this for our trial and the TOPO! software indicates good probability for success, we will test this as we install the 3 repeaters. Thanks to Greg Ching, Rick Cobb, Dan Metzger, Terry Mooster, Hans Rohner, Ric Turley, Jim and Todd Cowart, and George Watson for helping with this last test before starting repeater installation.
12 Jan 2002	Braving gusty winds and chilly weather, two legs of the Magnolia Golden Triangle were tested successfully. From Winiger Ridge to Twin Sisters we got a 33 dB signal! From Winiger Ridge to Porter Ranch we got an amazing 41 dB!! Thanks to John Carder, John Chase, Greg Ching, Rick Cobb, Alan Dunwell, Mark Lindberg (from Wondervu), Dan Metzger, Mike Morrissey, Hans Rohner, and George Watson.
12 Jan 2002	Bulk purchase of network cards and antennas in progress.
11 Jan 2002	MRIC board meeting at Greg Ching's house. Discussions continued on incorporation issues and initial trial subscribers. Immediate goals are to finalize by-laws and create repeater tower hosting agreement, subscriber agreement, and promissory note (for repaying seed money loan).
03 Jan 2002	The PUMA monthly meeting allowed Greg Ching and Rick Cobb to explain our Broadband plans to a few new faces. Special thanks to our hosts Dan Metzger and Jennifer Stewart!
20 Dec 2001	Magnolia Road Internet Cooperative officially incorporated within the State of Colorado. To see a PDF file of our articles of incorporation, click here (166K).
15 Dec 2001	Good turnout at the PUMA potluck gave MRIC a chance to explain our Broadband plans. Using an unamplified connection with heavy snowfall we were able to

	sustain a 5 dB signal (still 700 kBaud or 20X typical Magnolia dial-up speed) for perhaps an hour before the signal degraded. At least one person offered to write a check to MRIC! Thanks to Greg Ching, Rick Cobb, Hans Rohner, Pablo Sanchez, Paul Kolesnikoff, and Ric Turley for setting up the Rohner-McClellan link. Special thanks to our hosts Roz and John McClellan who really helped *promote* our presence!
12 Dec 2001	Insurance broker said MRIC turned down again. Sigh. Will continue search next week but self-insurance may be necessary.
08 Dec 2001	Initial testing between Porter Ranch and Twin Sisters did not result in a good signal. However, in the process of setting up the PUMA potluck demo we may have found a location to reach Porter Ranch. Thanks go to Mary Jo Brodzik, John Chase, Greg Ching, Rick Cobb, Bob Gailer, Paul Kolesnikoff, John McClellan, Dan Metzger, Hans Rohner, Pablo Sanchez, and George Watson for braving the sunny cold (Ray Browning's perfect tower raising attendance streak ended at three as he shreds Winter Park; he's still batting .750). This was the first time we used both mobile towers! We promise to be faster next time....
01 Dec 2001	Despite gusty winds, a very strong signal (25 db) was picked up between George Watson's house and two homes on Forsythe Rock. Thanks go to Doug Benson, Bob Bows, Ray Browning, Greg Ching, Kristine McInvaille, and George Watson for braving the cold!
28 Nov 2001	Rick Cobb receives his Lucent Technology Orinoco Gold PC card ($99) for his laptop. He installs it, and is able to connect to George Watson's home wireless network with no additional equipment at a distance of a few hundred feet.
27 Nov 2001	mric-community Yahoo! group set up for announcements/discussions.
23 Nov 2001	Successful mobile tower testing at HCFD #4 and George Bogg's house confirms connectivity to George Watson's repeater tower. Pine Glade & Magnolia to Frontier & Hazelwood is no problem! Need second mobile tower assembled for missing link to Porter Ranch. Ray Browning, Scott Browning, George Boggs, Greg Ching, Rick Cobb, Alan Dunwell, Craig Irwin, Ric Turley, Pablo Sanchez, and George Watson participated in this field test.
19 Nov 2001	Pablo and Rick represent MRIC at the Nederland Wireless Internet meeting sponsored by Peak to Peak Healthy Community Project and ***rock the house!*** Armed with flip chart and VGA projector, they cast their hooks into the audience and reel back in two subscribers from eastern Ridge Road. The TOPO!

	map software was instrumental in illustrating elevation profiles between potential subscribers and access points.
18 Nov 2001	Planning committee meets at Rick Cobb's house to discuss schedule for point-to-point testing and participation at the Nederland Broadband meeting.
15 Nov 2001	Insurance broker reports that American Equity is considering our application.
09 Nov 2001	Second portable tower and base received.
02 Nov 2001	Second portable tower and base ordered for point-to-point signal testing.
01 Nov 2001	First public demo of 802.11b connection between George Watson and Greg Ching's houses (roughly .9 miles with NO direct line of sight between the two points). Rick Cobb, Pablo Sanchez and Ray Browning helped with mobile tower set-up (using $90 antenna). 11 Mbps link demonstrated running for over 2 hours. More demos planned before upcoming PUMA meetings (next is Saturday, Dec. 15th). Broadband fever detected amongst those in attendance.
31 Oct 2001	Portable tower and base received; George Watson begins configuration.
30 Oct 2001	Taggart & Associates (insurance broker used by the Colorado Internet Cooperative) reports MRIC turned down by Travelers, Zurich and Hartford as the insurance industry tightens underwriting guidelines. Additional companies sought. Increasing personal insurance not an option as commercial insurance is a different beast.
26 Oct 2001	Rick Cobb orders a portable telescoping tower and base for testing signal strength in preparation for a demo prior to the PUMA meeting at Greg Ching's house at 6:00 on Nov. 1
30 Sept 2001	Planning meeting at George Watson's house. Incorporation papers signed. Less expensive tower design in progress due to lack of state funding. Prep work needs to be done prior to pre-PUMA meeting at Greg Ching's house on Nov 1. Over 50 potential subscribers; need to set up new Yahoo alias to push news out to them.
15 Sept 2001	State freezes all grants due to slowing economy.

10 Sept 2001	PUMA newsletter article on MRIC draws interest of new group of potential subscribers.
27 Aug 2001	Decision made to use Fortis Communications as initial T1 service provider. T1 end-point and repeater tower at John Carder's house.
24 Aug 2001	Rob Savoye says he will be meeting with the Colorado Beanpole project folks next week. Tom Plant says funding still looks good at this point.
22 Aug 2001	Lakeshore resident Brad Keiser learns about MRIC.
09 Aug 2001	MRIC attends NedNet/Peaknet meeting in Nederland. MRIC members meet afterwards to review incorporation documents.
07 Aug 2001	Tom Plant takes grant proposal to committee.
04 Aug 2001	MRIC flyer left at PUMA potluck.
03 Aug 2001	Coal Creek residents ask to join MRIC. They are encouraged to start their own co-op.
02 Aug 2001	"Code Red" worm attack no problem for magnoliaroad.net.
01 Aug 2001	George Watson reports 5 Mbps from 1/4 mile away using standard PCMIA card antenna.
31 Jul 2001	PUMA newsletter article prepped for August issue. 44 potential subscribers.
29 Jul 2001	George Watson repeater tower installed.
23 Jul 2001	Meeting with lawyer regarding MRIC incorporation.
21 Jul 2001	Meeting with Tom Plant & NedNet/Peaknet regarding grant.
17 Jul 2001	Collected GPS data for 34 potential subscribers.
16 Jul 2001	www.magnoliaroad.net up and running.

15 Jul 2001	Third meeting to go over designs & progress. PDF maps of GPS locations generated.
13 Jul 2001	State Representative Tom Plant offers to seek funding for a pilot project.
09 Jul 2001	Second meeting to review design. Propagation drive around tests with GMRS handhelds.
06 Jul 2001	MRIC Yahoo group forms.
05 Jul 2001	Conversations between MRIC and SL.net begin.
02 Jul 2001	T1 provider shopping begins
02 Jul 2001	Invitation to join MRIC goes out on PUMA e-mail. Conversations begin between MRIC and NedNet/PeakNet.
01 Jul 2001	MRIC founders meet for the first time.
29 Jun 2001	Domains MagnoliaRoad.net and Magnolia-Road.net are registered.
25 Jun 2001	Greg Ching and Allen Schmitt-Gordon express interest in the project.
19 Jun 2001	George Watson thinks an upgrade to a T1 connection would be required to handle multiple subscribers to his wireless network. Preliminary inquiries are made to determine if we can find 4-5 subscribers willing to share the cost of a T1.
17 Jun 2001	George Watson tests reception at Rick's house. Rick fantasizes of working from his porch connected to the Internet via George's network and ISDN line.
15 Jun 2001	Rick Cobb asks his neighbor George Watson about his home wireless network.
05 Jun 2001	Allen Schmitt-Gordon and Paul Kolesnikoff join the discussion on how to bring PPHCP's project to Magnolia.
31 May 2001	Rob Savoye of PPHCP's High Speed Internet Project starts Magnolia discussion with Greg Ching.

06 Mar 2001	Mountain Ear reports on 60 people attending a Peak-to-Peak Healthy Community Project (PPHCP)meeting on high-speed Internet access alternatives.
January 1999	George Watson sets up his wireless LAN and dreams of faster access.
Dec 1997	Bill Clark starts Sugarloaf.net (SL.net), providing T1 speeds via low-power radio transceivers.
1996	PeakNet forms, opening free internet kiosks in Nederland.

Data from email exchanges

1. MRIC, merged with Sugarloaf and other smaller coops that were inspired by MRIC to become a bigger network

2. MRIC did not qualify for state funding as their total expenditure was below $100 000

Appendix D.2 MRIC Data extracted from United States National Broadband Map

Appendix D.2.1 Details of penetration of the service

The signal coverage of the MRIC network spans beyond the MRIC locality deep into other part of Colorado. This section provides an overview over the reach and level of usage of the network.

Penetration of the MRIC network in Colorado

	Item	Population
1	Population Served	20, 024
2	Housing Units	9,640
3	Total area (Sq.Miles)	138
4	Population Density (people per sq mile)	87

Population of Colorado Served

	Item	Data Rates	Population Served
1	Download Speed	3 -6 Mbps	**0.4%** of population
2	Upload Speed	768Kbps – 1.5Mbps	**0.4%** of population

Appendix D.2.2 Demographic served by MRIC Coverage

Age	Percent Population	State
under 5	3.9%	5.8%
5 - 19	11.0%	20.8%
20 - 34	24.1%	19.1%
35 - 59	42.4%	33.4%
60+	18.7%	21.0%

Source: http://www.Broadbandmap.gov/about-provider/magnolia-road-internet-coop/in-state-of-colorado

Usage of the service by age

Age	Percent Population	State
under 5	3.9%	5.8%
5 - 19	11.0%	20.8%
20 - 34	24.1%	19.1%
35 - 59	42.4%	33.4%
60+	18.7%	21.0%

Source: http://www.Broadbandmap.gov/about-provider/magnolia-road-internet-coop/in-state-of-colorado

Education level of users served

Education	Percent Population	State
HS graduate	96.3%	86.5%
B. Degree +	61.9%	32.4%

Source: http://www.Broadbandmap.gov/about-provider/magnolia-road-internet-coop/in-state-of-colorado

Appendix E. Open Coding Process

In this process, Open codes or concepts are extracted from Paragraphs, phrases, sentences and words of the respondents that were interviewed.

Appendix E.1. Open Coding Process for Developed Countries

In this process, Open codes or concepts are extracted from Paragraphs, phrases, sentences and words of the respondents from the developed country cases that were interviewed.

Appendix E.1.1 Open Coding for DjurslandsNet

Interviews	**Response**	**Paragraphs, Words, Phrases and sentences from interview responses**	**Open Codes**
Can you tell us about the history of Djursland?	The map we see is from May 2007. I do not have the common map because in 2005 the network was decentralized and from one network established by me it was formed into each board with its own local area. At a time it was 10 networks actually based on the original 8 municipalities of Djursland. We had 8 municipalities and they formed themselves after the municipality reform. We now have 2 merged municipalities in 2007. We now have the Nordjurs and Suddjurs municipality. When I started Djurslandsnet, I saw it as a whole without looking at the borderlines. People agreed to it, but when the municipality reforms were promoted, it meant something to the volunteers in our network. So they tended to go to the south or the north. Here you	the network was decentralized and from one network established by me	Project completed
		because in 2005 the network was decentralized	Decentralized from the start
		was 10 networks actually based on the original 8 municipalities of Djursland …So they tended to go to the south or the north	Now fragmented into 10 networks
		When I started Djurslandsnet, I saw it as a whole without looking at the borderlines	Bjarkes vision of unity
		, but when the municipality reforms were promoted, it meant something to the volunteers in our network. So they tended to go to the south or the north.	Municipality reforms enabled break up
		This map shows the nodes. We have one omni-antenna, in other places several directional antennas. We had 250 overlapping nodes,	Technical planning
		today in the whole of Djursland, there are about 500 nodes	500 nodes in djursland
		Ronders net, when we were divided, they are	Break up alliances

	can see the maps for the nodes from the North and the south. This map shows the nodes. We have one omni-antenna, in other places several directional antennas. We had 250 overlapping nodes, but today in the whole of Djursland, there are about 500 nodes. 2 of the municipalities, Nore Djurslands municpality, Rougso municipality and Sonderhald municipality from the Primanet. The 1st municipality called the Sonderhelds net, now they are known as west Djurslands net. They have combined recently Rosenholm net as you see it goes all the way to the southern part, so the name is alright, West Djurslands net. Here in the south, I called it Ronders net, when we were divided, they are called Egensnet today. They have integrated with another network in the countryside with villages. I could see as the then chairman was that it would take time before they got the service. My intention as the then chairman was to serve them with the service. This was my aim, but it was a contradictory that they will come last. We formed a board and named the coop Egensnet number 9, because we had about 8 already. Out here in Grenaa, I was also chairman in the network and it was difficult to establish the network here because it is a city and city people want people to do something for them. I don't think so, nobody will. In the	called Egensnet today. They have integrated with another network in the countryside with villages.	
		Out here in Grenaa, I was also chairman in the network	Bjarke also chairman of Grenaa
		it was difficult to establish the network here because it is a city and city people want people to do something for them.	Challenge of establishing network in city
		In the countryside, people know they have to do it themselves	Country side, people act for themselves
		. Grenaa and Ebeltoft were late to start.	City late to start
		I actually made boards here before we actually started a physical network.	Boards created before infrastructure deployment
		. Today 10 000 households, firms and institutions is connected to this technology, it gives access to about 1 third of the population of Djursland,	Household penetration coverage
		The opportunity to do it was based on poor people who decided to do things themselves	Self determination
		several volunteers are involved in the network	Use of volunteers
		they are involved in their own area, their own local area.	Volunteer jurisdiction

	countryside, people know they have to do it themselves. Grenaa and Ebeltoft were late to start. I actually made boards here before we actually started a physical network. The last thing i did with Grenaasnet before I retired, when i retired there were about 30 nodes, today there are about 80 nodes. The others have not made maps yet the same goes to the middle community which is the Middjurslands net. Today 10 000 households, firms and institutions is connected to this technology, it gives access to about 1 third of the population of Djursland, It is a huge network. It was a huge task. The opportunity to do it was based on poor people who decided to do things themselves. Today, several volunteers are involved in the network. They are involved in such a way that they are involved in their own area, their own local area.		
The 1 third, is that the actual number of subscriptions?	We are 82 000 living in Djursland. But if you look at it at household level, we have about 30 000 households. 10000 connections are made by those 500 nodes, each node serves 30 customers be it family company, institution, etc.,. It had to be that small because we are not a commercial entity. To ensure quality of service, 30 users per cell site was was max. People have access to 12 to 16 MB downlink and	We are 82 000 living in Djursland	Population of djursland
		we have about 30 000 households	Number of household in djursland
		10000 connections are made by those 500 nodes, each node serves 30 customers be it family company, institution, etc	Level of coverage-connection
		we are not a commercial entity	Not Commercial
		To ensure quality of service, 30 users per cell site was maximum	Ensure QOS
		The high bandwidth was necessary to enable a high capacity usage	Broadband speed sought for

	10 to 12 MB upstream. The very important feature that i had to commend everybody from the beginning was that we should have more or less synchronized so each board could have their servers, so that we do not have to depend on commercial partners. The high bandwidth was necessary to enable a high capacity usage. I learnt this from experience in the 90s. Each should have a high bandwidth. That was the introduction.	10 to 12 MB upstream	Facilitate high uplink
		to 12 to 16 MB downlink	Facilitate high capacity usage
		from the beginning was that we should have more or less synchronized so each board could have their servers, so that we do not have to depend on commercial partners. The high bandwidth was necessary to enable a high capacity usage. I learnt this from experience in the 90s.	Bjarke's Previous experience with wireless
(On our way here, I could see a lot of trees, the settlement was scattered, yes there are also hills. From the technical point of view and using wireless there will be technical issues. You have mentioned that you use a lot of nodes). You have to be technical to know how to navigate the connectivity in such an area? What is your professional background?	I am a trained painter from the academy of fine arts in Aarhus many years back. As a culmination of that education, I became educated in the science of creative intelligence in the 1970s. That became the final part of my painter education to become a teacher. We came to the practical part which involves deep meditation because through deep meditation, you can power your creativity. I was coordinator of teaching and meditation in the middle region of all Djursland. At that time, we had collective teachers and we were able to go to all parts of the city for 7 years. In this organization, we had a conflict around the status of a teacher, I made a report that redefined who a teacher should be. The idea was that you should not consider yourself more than the students. We are equal and there should be democracy. We may know better, but it will not change our subjective status.	I am a trained painter from the academy of fine arts in Aarhus	Bjarke trained as a fine artist
		I became educated in the science of creative intelligence in the 1970s	Bjarke educated in creative intelligence
		the final part of my painter education to become a teacher	Bjarke became a fine arts teacher
		I was coordinator of teaching and meditation in the middle region of all Djursland. At that time, we had collective teachers	Bjarke's Connection to teachers in djursland
		We are equal and there should be democracy	Bjarke's ideal of democracy
		. I decided to make a perpetual energy machine my idea was not speculative, it was that I could make some type of start-up that could make energy, if it worked out, I would rent it to industrialized countries	Bjarke was an innovative thinker
		. I tried with magnetic energy, gravitational energy. Within that time, I tried all sorts of energy; my father had all types of tools.	Bjarke could think outside the box
		I tried all sorts of energy; my father had all types of tools. I could go there to do my experimentation. At the end of the 1990s I decided	Bjarke's lesson with failure

<table>
<tr><td rowspan="10"></td><td rowspan="10">Teachers in Copenhagen had an opposite view that the teacher should be higher. I lost the dispute; i did not form the majority so i had to leave. I was sorry for that because the organization became a self-sufficient entity. This was about 1980, so I considered what to do. I decided to make a perpetual energy machine my idea was not speculative, it was that i could make some type of start-up that could make energy, if it worked out, i would rent it to industrialized countries and give it for free to developing countries so that you could have tools for a kind of motor. I tried with magnetic energy, gravitational energy. Within that time, I tried all sorts of energy; my father had all types of tools. I could go there to do my experimentation. At the end of the 1990s I decided to make something useful. I think I will find the energy solution. I do not believe in positivist science, but from an interpretive mode. I have an open mind, of the universe. I felt I was wasting my time if I could not come up with something useful. When I was about 20, I was a self-made artist. I considered myself, not a human being, but a being. I was writing a lot of notes which will clarify understanding in our learning, society. The notes were one note per line for the reader to read and understand. My landlord</td><td>to make something useful</td><td></td></tr>
<tr><td>I considered myself, not a human being, but a being.</td><td>Bjarke’s self-perception</td></tr>
<tr><td>I was writing a lot of notes which will clarify understanding in our learning, society.</td><td>Bjarke was a dreamer</td></tr>
<tr><td>I drifted it into the future in my mind; this was in 1967 to find out how it would be possible to paint the patterns on TV screen.</td><td>Bjarke could think outside the box</td></tr>
<tr><td>I considered it would be possible to someday paint on the TV screen, so I could get rid of oil and turpentine.</td><td>Bjarke could sense potential in technology</td></tr>
<tr><td>I thought that in the 80s someone would be provoked into linking the typewriter with the TV.</td><td>Bjarke could conceptualize solutions</td></tr>
<tr><td>So I ended up to find a solution which was about 60000 Dkk. I took a chance and bought the PC it from the US.</td><td>Bjarke’s is willing to try his thoughts</td></tr>
<tr><td>. So I stopped dreaming about the machine and I got computer magazines from Germany and I studied the advertisement. The advertisement made me to write about 200 firms around the world to know how I could have a PC with a good resolution</td><td>Bjarke is willing to overcome obstacles to see his thoughts through</td></tr>
<tr><td>It was quite expensive. The monitor was 20 000dkka special graphic cards which could run the monitor was also acquired with the accessories and a color printer.</td><td>Bjarke is not deterred by high cost</td></tr>
<tr><td>We learnt it from the Danish computer which was a disadvantage, it was compatible. They tried to have a Danish standard, but it was not possible. So the accessories that were bought from the US were useless because they were not compatible with the Danish computers. So started from scratch, to see if I could have some</td><td>Bjarke learns from mistakes</td></tr>
</table>

	wanted me to make patterns on their window blinds. I had a machine in my workshop that would take the material and make the patterns. In those days oil and turpentine were used. So I thought of how a machine could be made that would make me independent of oil and turpentine. I drifted it into the future in my mind; this was in 1967 to find out how it would be possible to paint the patterns on TV screen. In those days colour TV was new in Denmark. I considered it would be possible to someday paint on the TV screen, so I could get rid of oil and turpentine. I thought that in the 80s someone would be provoked into linking the typewriter with the TV. I did not want to try it due to the failure of my energy machine, so I believe that the technical people would think of it. I did not know it would be called a computer. I just thought about it conceptually. I thought when that is done; I could get my parents to get a loan to buy it. So I continued to write notes about these concepts. The idea was that when I get to 40, I would consider the notes to see if they would be useful. Then I would make use the typewriter and PC to paint different alphabets to make patterns by making sentences on top of the painting. I considered that 1 would use 24 years to make 8808 to infinity concept of the different art concepts.	knowledge.	
		When I put all this together, I had gone an evening school in Grenaa to learn how to use a PC.	Bjarke embarked on personal capacity building
		So started from scratch, to see if I could have some knowledge. I attended the academy of fine arts in Copenhagen and a school in Aarhus. I had to learn	Bjarke is willing to learn new solutions
		So I had to start all over again. I had to learn how to save to the floppy disk. I asked for help from the experts,	Bjarke calls for help
		So in the process, I learnt how to configure programmes in the PC and got a lot of experience on the hardware repairs of the PC.	Bjarke uses his skills to identify problems that need solution
		When I came around to the local community in 1990, firms were beginning to have their accounting on PC. They had a problem. I came around and told them it was a normal problem, and since I had gone through similar PC problems for 2 years, I could not turn my backs on them. So I sat down and showed them how to solve it. I could find the reason for the problem.	He uses his new found knowledge to solve problems
		So I sat down and showed them how to solve it. I could find the reason for the problem.	Bjarke developed problem solving skills
		This changed my situation from picture painting, repairing computers as I was asked to teach at the local production school and local day high school.	He is willing to change course to adopt better solutions
		I was considered knowledgeable I was told to form a curriculum for the county in Aarhus to	His skills is recognized by people

<table>
<tr><td rowspan="13"></td><td rowspan="13">Here I can make calendars with different concepts. That, combined with the feeling not to make an energy machine, so I decided to get the Amiga color computers, when it was released. I considered Amiga and found that the pixel was not high enough. You could have high resolution if you had 16 colors. If you wanted many colors, you needed another solution. So I stopped dreaming about the machine and I got computer magazines from Germany and I studied the advertisement. The advertisement made me to write about 200 firms around the world to know how I could have a PC with a good resolution. So I ended up to find a solution which was about 60000 Dkk. I took a chance and bought the PC it from the US. I bought it from US cos I could get half the price. The PC was high resolution 20 inches, this was about 1988. It was quite expensive. The monitor was 20 000dkka special graphic cards which could run the monitor was also acquired with the accessories and a color printer. When I put all this together, I had gone an evening school in Grenaa to learn how to use a PC. We learnt it from the Danish computer which was a disadvantage, it was compatible. They tried to have a Danish standard, but it was not possible. So the accessories that were bought from the US were useless</td><td>have support for networks, computers,</td><td></td></tr>
<tr><td>I was an IT teacher</td><td>He is employed to teach his new found knowledge</td></tr>
<tr><td>I became a teacher and more than that, because I had many students in different schools. So I met my students everywhere.</td><td>Being a teacher led him to meet many people</td></tr>
<tr><td>We did not have people who knew what the PC was all about</td><td>People who could not use PC</td></tr>
<tr><td>people will meet me with PC problems.</td><td>People need his help to repair pc</td></tr>
<tr><td>We got the school and we began the computer bovl there after some.</td><td>School used for bovl</td></tr>
<tr><td>The community came to be known as the bovl community.</td><td>Bovl community is named</td></tr>
<tr><td>I tell this story because this is how it was possible to raise the volunteer movement</td><td>Bovl grows</td></tr>
<tr><td>We now have bovl evenings at different times at different evenings.</td><td>Bovl meeting time fixed</td></tr>
<tr><td>I tell this story because this is how it was possible to raise the volunteer movement.</td><td>Bovl enabled the formation of djurslndsnet</td></tr>
<tr><td>I was told to form a curriculum for the county in Aarhus to have support for networks, computers, so that we could invite people besides students only to have the feeling of what it meant to use a PC. I made a list of tools and what it would cost us. So I decided that it had to be done the hands on way.</td><td>Reason for self-determination of bovl</td></tr>
<tr><td>I was considered knowledgeable I was told to form a curriculum for the county in Aarhus to have support for networks, computers, so that we could invite people besides students only to have the feeling of what it meant to</td><td>Bjarke had previous management experience</td></tr>
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	because they were not compatible with the Danish computers. So started from scratch, to see if I could have some knowledge. I attended the academy of fine arts in Copenhagen and a school in Aarhus. I had to learn. Later I had to settle with windows because their drivers could go with everything. After something I had everything running, but after every three quarters of an hour the machine froze up. So I had to start all over again. I had to learn how to save to the floppy disk. I asked for help from the experts, but non could help. Some came to my house and stayed all night, but could not solve the problem. At some point I had to call different firms to find out what the problem was. We decided to analyze the graphic adapter. After 2 years the problem was solved. So in the process, I learnt how to configure programmes in the PC and got a lot of experience on the hardware repairs of the PC. When I came around to the local community in 1990, firms were beginning to have their accounting on PC. They had a problem. I came around and told them it was a normal problem, and since I had gone through similar PC problems for 2 years, I could not turn my backs on them. So I sat down and showed them how to solve it. I could find the reason for the problem. This changed my situation from picture painting, repairing computers as I was asked to	use a PC.	
		The County decided not to help because it was not useful.	Previous example of no county help
		From this experience through the years 1993 to 2000, we learnt to make our website and not depend on the municipality.	Information portal created-website
		The domain name is owned by the union.	Small union formed

	teach at the local production school and local day high school. We did not have people who knew what the PC was all about, so there was that need to know, hence I was hired. I became a teacher and more than that, because I had many students in different schools. So i met my students everywhere. People would meet me on the street; people will meet me with PC problems. If i was sent by my wife to get milk Ii would return 2 hours later because i met people and i had to explain the problem and solutions to them. Then they said the computer, we teach in school is fine, but when i come home, I can’t use mine. So can’t you make an evening once in a while where we can come with our own computer, so you can help us. I and my wife lived in a small house, so one day i was at Rougso and a student asked for help. He was the chairman of the radio in northern Djursland. We got the school and we began the computer bovl there after some. The community came to be known as the bovl community. In time people began to help. We now have bovl evenings at different times at different evenings. I tell this story because this is how it was possible to raise the volunteer movement. We knew we would be left behind if we did not do something. When we started the bovl, I was an IT teacher. I was considered knowledgeable I was told to		

	form a curriculum for the county in Aarhus to have support for networks, computers, so that we could invite people besides students only to have the feeling of what it meant to use a PC. I made a list of tools and what it would cost us. The County decided not to help because it was not useful. So I decided that it had to be done the hands on way. From this experience through the years 1993 to 2000, we learnt to make our website and not depend on the municipality. Here we could upload different information about the municipalities. People had emails on the website domain name. People paid 20 dkk a year. We had about 200 names with 1/2 a gigabyte free space. The domain name is owned by the union. I pay for them. If anyone wants my support outside the bovl, I charge 100dkk for it. The money pays for the domain name.		
How did the Wireless network concept emanate from the bovl evenings?	I had some friends who were into amateur radio and one of them had a walkie talkie computer network. They will take the walkie talkie and use a computer card and an antenna just like the network today. At that time people had modem and they could enter their GPS where they could put their software driver. It was like the internet. The walkie talkie network, you chose the channel and say to everybody talking, don't use	I had some friends who were into amateur radio and one of them had a walkie talkie computer network	A friends experience with walkie talkie network
		. At that time people had modem and they could enter their GPS where they could put their software driver. It was like the internet	Inspiration for wireless network from walkie talkie
		Then we had this network and i was communicating like similar to Skype where people around Djursland could call Holland. We had repeaters all over Djursland.	Perceived usefulness of wireless network from actual usefulness of network
		I could perceive this by the	Evidence of low

	this channel it is used for data. Then we had this network and i was communicating like similar to Skype where people around Djursland could call Holland. We had repeaters all over Djursland. I had put out a message about the war in Yugoslavia, as the media were lying. We made a call to Holland to know what was really happening and we got a feedback that there would be a war and that the media was lying. But the experience that with no money, but just electricity have a computer and a computer standing there, but it was slow 1200b per second. You had to send packages and repeated packages. There was latency on the network. The possibility of what we could do at that time was not different from the internet today. The low speed from graphics was not a problem, we could still use the network cos we used the DOS interface. We could download software northern commander could be downloaded on the network from somebody in Aarhus. So this experience was used at the bovl evenings, so that people will prepare at this time in 1993. I made people use it as a way to persuade them that this was the future. In my dream 25 years earlier written in the notes, Many people did not buy the idea, but later people bought network cards to be connected. The youngster	rise in demand of other products leading to the fall in prices. This happened with the cartridges, graphic cards, etc.	cost of wireless network from walkie talkie
		We could download software northern commander could be downloaded on the network from somebody in Aarhus	Perceived usefulness of wireless network from actual usefulness of walkie talkie network
		So this experience was used at the bovl evenings, so that people will prepare at this time in 1993.	Outdooring of walkie talkie network at bovl
		I made people use it as a way to persuade them that this was the future	Walkie talkie network as persuasion to prepare for Bjarke's future
		Some kind of maturity will come about I was hoping that the development of this equipment, which was very slow,	Visualization of the future from walkie talkie experiment
		The youngster used it mostly for playing games.	Youngsters play games showing potential usefulness
		for the coming for low price fast speed of this device will come. I could perceive this by the rise in demand of other products leading to the fall in prices.	High speed low cost radio equipment perceived
		This happened with the cartridges, graphic cards, etc. There was an exhibition in Copenhagen, I saw three piles and on top of it higher and higher, there was a cd rom, a monitor and there was a CD writer and they cost 75000 and 80000 dkk per piece. This was in 1987 or 88 and this was expensive and later, they became cheaper and new version came up, today people do not write CD readers anymore.	High speed low cost perception backed by evidence

<table>
<tr><td rowspan="13"></td><td rowspan="13">used it mostly for playing games. We had to make extra arrangement two times a month to come and play games. Some kind of maturity will come about I was hoping that the development of this equipment, which was very slow, for the coming for low price fast speed of this device will come. I could perceive this by the rise in demand of other products leading to the fall in prices. This happened with the cartridges, graphic cards, etc. There was an exhibition in Copenhagen, I saw three piles and on top of it higher and higher, there was a cd rom, a monitor and there was a CD writer and they cost 75000 and 80000 dkk per piece. This was in 1987 or 88 and this was expensive and later, they became cheaper and new version came up, today people do not write CD readers anymore. So I could foresee that the radio equipment will be cheaper someday the moment it could be mass produced or mass sold. The price will come to a level where everyone can buy. That happened in 2000, the price for radio equipment was not below 10000 dkk. So i began to prepare. So that when the prices come to the affordable range we can do something about the radio network. We had to be ready with the organization. That when the price gets to what we can afford, we can buy it collectively hence we would be ready, So that was why i</td><td>So I could foresee that the radio equipment will be cheaper someday the moment it could be mass produced or mass sold.</td><td>High speed low cost radio equipment expected</td></tr>
<tr><td>That happened in 2000, the price for radio equipment was not below 10000 dkk. So I began to prepare. So that when the prices come to the affordable range we can do something about the radio network.</td><td>The low cost radio equipment happens</td></tr>
<tr><td>We had to be ready with the organization</td><td>Preparation in anticipation of low cost radio</td></tr>
<tr><td>So that was why I formed the Djurslandsnet organization from the bovl organization.</td><td>Bovl presents a potential for wireless organization</td></tr>
<tr><td>I founded it in October 2001</td><td>Djurslandsnet founded</td></tr>
<tr><td>My idea was that the network should be free.</td><td>Free network-vision should be free</td></tr>
<tr><td>But I could not convince the municipality with the idea of each household having internet connection wirelessly.</td><td>Municipality not convinced with our idea</td></tr>
<tr><td>Aside the municipality people did not buy the idea easily, even at conferences</td><td>People did not see the possibility</td></tr>
<tr><td>. We had a conference in the townhall.</td><td>Attempt to enlighten people on potential wireless network</td></tr>
<tr><td>5 to 6 people from the bovl attended the conference. We were to advice on how to make the network for the community</td><td>Bovl members helped in the enlightenment</td></tr>
<tr><td>We differed with the municipality on how to make a good community network</td><td>Municipality not convinced with our idea</td></tr>
<tr><td>almost everyone except TDC found our idea very impressive,</td><td>Private sector loved the idea</td></tr>
<tr><td>but when they did the calculations; they realized that it could not be done on a commercial basis</td><td>The private sector could not see the market potential</td></tr>
</table>

	formed the Djurslandsnet organization from the bovl organization. I founded it in October 2001. My idea was that the network should be free. But I could not convince the municipality with the idea of each household having internet connection wirelessly. Aside the municipality people did not buy the idea easily, even at conferences. We had a conference in the townhall. 5 to 6 people from the bovl attended the conference. We were to advice on how to make the network for the community. We differed with the municipality on how to make a good community network. After the break we explained out concept, but the administration did not see the feasibility. We did ask the network operators if they would come in to invest in rural areas. I had negotiated with 36 companies to have a conference with them, almost everyone except TDC found our idea very impressive, but when they did the calculations; they realized that it could not be done on a commercial basis because it would not pay off. That was why they decided not to deploy Broadband in general at that time.	because it would not pay off.	
You wanted to have a gateway; you did not really decide whether it would be wired or wireless?	We wanted equal terms for everyone; we were open to whatever Broadband solution. My experience with radio technology made me opt for radio. I did not know they will call it Wi-Fi.	We wanted equal terms for everyone	Vision of the network-everyone should have equal service
		; we were open to whatever Broadband solution	Initially open to any Broadband solution
		My experience with radio technology made me opt	Bjarke opted for a radio solution

	It was Vic Hayes who made these standards for wifi. They also based their equipment based on the walkie talkie. They developed the standards in the 90s. He was made chairman of that committee by IEEE to develop this standard for public use of radio frequency. They did not know it would be called Wi-Fi because it was a 10 year development before they had something stable for public consumption.	for radio	
		I did not know they will call it Wi-Fi. It was Vic Hayes who made these standards for wifi.	Wi-fi standard was being developed
Why Wifi?	Wifi was cheaper. When I compared the different technologies, a cabled infrastructure was the possibility, and fixed line was predominant. We could pay 70Dkk per month for interconnecting to the fixed line infrastructure aside the bills that were bundled with internet access, etc. I was very particular that the cost of using the service overall must not go beyond 100dk a month because the F were rural dwellers. The people in the rural area did not really think they needed the service. So if the cost was high, no one would get it. At that time a 2MB connection was 1150 DKK. My ambition was that every household should have a 2mb connection and it must not cost more than 100 dkk. My idea was that the cost of equipment should not be over 1000dkk one-time payment and this payment should be flexible. There are lots of poor people and	Wifi was cheaper	Wi-fi was cheaper than other wireless
		When I compared the different technologies, a cabled infrastructure was the possibility, and fixed line was predominant.	Fixed infrastructure was predominant
		. We could pay 70Dkk per month for interconnecting to the fixed line infrastructure aside the bills that were bundled with internet access, etc.	High cost of fixed line connectivity deterred rural connectivity
		My idea was that the cost of equipment should not be over 1000dkk one-time payment and this payment should be flexible. There are lots of poor people and unemployment in the countryside.	Bjarke designed a low cost access for rural areas
		The people in the rural area did not really think they needed the service. So if the cost was high, no one would get it.	No perceived usefulness from rural dwellers for connectivity
		There are lots of poor people and unemployment in the countryside.	Rural dwellers were poor and unemployed
		So if the cost was high, no one would get it. At that time a 2MB connection was 1150 DKK.	Digital divide existed
		But my understanding was that I could make a change	Wireless network could facilitate

	unemployment in the countryside. They had a community at that time that is falling apart as they cannot compete with city people. But my understanding was that I could make a change by making at least 200 more employed, I could take the tax rise in the municipality would help develop more roads and keep the institutions alive. Because about 200 more people in these areas paying taxes is a lot of money for the municipality. And actually when I calculated it from today and backwards from the beginning. The organization of these networks around the volunteers has saved a quarter of a billion dkk altogether in lower fee than if they had the opportunity to get the commercial internet. They would have paid a quarter of a billion. It is not important to people in Grenaa or Ebeltoft as they earn higher wages, but in the rural areas, it meant they came to the wagon and they can do things that could be done on the internet to boost their economy.	by making at least 200 more employed, I could take the tax rise in the municipality would help develop more roads and keep the institutions alive. Because about 200 more people in these areas paying taxes is a lot of money for the municipality.	employment
		The organization of these networks around the volunteers has saved a quarter of a billion dkk altogether in lower fee than if they had the opportunity to get the commercial internet	Wireless network could lead to user saving money due to low cost
		in Grenaa or Ebeltoft as they earn higher wages,	Urban Djursland were high earners
		in the rural areas, it meant they came to the wagon and they can do things that could be done on the internet to boost their economy	Rural djursland had the potential to do things by themselves
Was there any Skepticism in the bovl group about your idea?	Yes, at that time, when I tried to convince people from my experience since 1992 with radio networks, in 1995, we started a community web as a homepage thing. I was asked to form a Danish project, where municipalities could apply for state money to become a .. I will explain it	Yes, at that time,	There was initial scepticism
		in 1995, we started a community web as a homepage thing	Information portal developed
		we did not have a board, we were volunteers and I was the initiative taker.	Bjarke's Prior experience with a small fixed internet project with municipality
		I was asked by the local municipality where I live	Bowl community helped in the

	this way, the idea was that the government to bring about development to the rural community, they were asked to form at least 4 projects for each and apply for money for each project that will facilitate this type of development in rural areas and 12 municipalities applied. I was asked by the local municipality where i live to make the bovl community make a project which will be about young IT access, we did not have a board, we were volunteers and i was the initiative taker. We formed a kind of board to decide if we could go into this or not. We decided we will volunteer and have a young nerd, give us a kind of IT housekeeper for the municipality. We were given a little more than 500 000DKK over three years to buy equipment and provide internet cafe services with 12 machines and networks. This was 5 or 6 years before the Djursland net. I was the project leader. We had the young guy paid for from the project. He became my opponent. He said wireless network was not possible. We would have to share the network and the QOS will be bad. We had a lot of dispute about what was possible. I was open minded about it and we decided to take the initiative based on one or the other, we had people coming to our workshop to explain how it could be done on cable and different kinds of wireless. So there were	to make the bovl community make a project which will be about young IT access	previous internet project with municipality
		We had the young guy paid for from the project.	Paid IT expert employed to help the internet project with municipality
		. We were given a little more than 500 000DKK over three years to buy equipment and provide internet cafe services with 12 machines and networks.	Public funding of municipality project
		I was the project leader	Bjarke gained project leadership experience from municipality project
		He became my opponent. He said wireless network was not possible. We would have to share the network and the QOS will be bad.	IT expert did not believe in wireless networks
		We had a lot of dispute about what was possible.	Dispute on which network to adopt for the project
		I was open minded about it and we decided to take the initiative based on one or the other, we had people coming to our workshop to explain how it could be done on cable and different kinds of wireless.	Bjarke learnt to be open minded
		So there were opponents in our own group, but the contention was just about what would be useful.	Perceived usefulness of technology debated
		At the first conference, the chairman was the director of the business community of Djursland. It was his responsibility to follow up on that conference, so one or two months later. I was called for an activist conference	Attempt to get Djursland business association lead the wireless idea
		We decided we will volunteer	Most workers in the municipality project were volunteers
		We had put a lot of time to	Technical plan for

<table>
<tr><td rowspan="16"></td><td rowspan="16">opponents in our own group, but the contention was just about what would be useful. Then the business community of Djursland had a conference in the middle of Djursland. We had people from Copenhagen, it was an expensive conference in 2001. We were 18 people from Djursland, 10 from the bovl community. I was made the spokesman for the group. The chairman of the conference of the conference did not give us the chance to speak; we were prepared to share our ideas. We had 10 to 12 volunteers from the municipality project alongside the paid nerd. The volunteers worked on different kinds of arrangement in public administration. Due to the unemployment, these projects gave them room for work experience. We had a lot of work hours. I worked more than 100 hours a week around the year. We had put a lot of time to develop and explore our plan, we placed our charts on all seats. The charts showcased different scenarios on how Broadband could be developed in Djursland. We had carried out research on how this could be done. We knew what it would cost; we knew what it could do and so on. Of course it was important for us to have the conference to understand it. So we did not have wait for people in Copenhagen to come and help. We are not familiar with people in the city. We had to do things for</td><td>develop and explore our plan,</td><td>wireless group developed</td></tr>
<tr><td>The charts showcased different scenarios on how Broadband could be developed in Djursland</td><td>Various deployment scenarios was developed</td></tr>
<tr><td>We had carried out research on how this could be done</td><td>Research on different scenarios developed</td></tr>
<tr><td>. We knew what it would cost</td><td>Cost of the wireless network determined</td></tr>
<tr><td>the county in Aarhus who were preparing fiber access between al the hospitals</td><td>County providing fiber for hospital connectivity</td></tr>
<tr><td>They had asked TDC to make a fibre between all the county hospitals and health houses</td><td>TDC facilitated county fibre</td></tr>
<tr><td>it was so expensive that they decided in the county to do it themselves.</td><td>County funding for fibre optics</td></tr>
<tr><td>we ended up having this fibre coming from Randers and returning to Arhus, and from Aarhus to Viborg and from Aarhus to Silkeborg and so on</td><td>Fibre optics connectivity arrives</td></tr>
<tr><td>He was laughing ahead, because it was not possible, and where would we get that kind of money.</td><td>County official doubted groups ability</td></tr>
<tr><td>in the break and asked how can the bovl community, be part of the fibre</td><td>Wireless group want to connect to the fibre</td></tr>
<tr><td>a conference organized by the administrators and politicians in Djursland</td><td>Conference to bring politicians and business community on board</td></tr>
<tr><td>the first conference, the chairman was the director of the business community of Djursland. It was his responsibility to follow up on that conference but did not,</td><td>Low interest from the Danish business association in the wireless</td></tr>
<tr><td>We collected 625 signatures per household. We had all these signatures and materials at the activist conference.</td><td>Signatures collected to show the demand for the wireless network</td></tr>
<tr><td>Then we had certain aims</td><td>Perceived usefulness</td></tr>
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	ourselves. They have always said we should work together to be a part of the agenda, but we are always so low on the agenda that we often do not count. So have made arrangements, talked with journalist and newspapers. It was strange that we were not allowed to speak. However, after the conference I spoke with one of those on the panel and one of those on the panel was a high administrator in the county in Aarhus who were preparing fiber access between all the hospitals. They wanted an electronic patient journal. They had asked TDC to make a fibre between all the county hospitals and health houses and it was so expensive that they decided in the county to do it themselves. But we ended up having this fibre coming from Randers and returning to Arhus, and from Aarhus to Viborg and from Aarhus to Silkeborg and so on. I think Viborg was not a part of it as it was a county, then, but Silkeborg was a part of it. This fibre ended up to be made, so i jumped at the county administrator who was on the panel at the conference, in the break and asked how can the bovl community, be part of the fibre because we wanted to make it accessible to the community. He was laughing ahead, because it was not possible, and where would we get that kind of money. I went to meet him at the office. We continued to cross each other's path.	they were to expand the quality of citizens in Djursland, keep the citizens in town and draw in more citizens to Djursland to aid the tax net,	of the network shared to the politicians and business community
		For us, we wanted it to be a Public private partnership	The initial plan was for it to be a PPP
		We had contact with parliament and the ministry of research and communications. And we met all the time people, but the people did not really care	No help from parliament and sector ministry
		because it was parliaments policy that telecom infrastructure community should be handled by the business community themselves (market).	Parliament favoured market facilitation
		The municipality was not allowed to support the initiative as that would be interference	Municipality were not allowed to be involved
		The 625 people as time had gone by. So I called a meeting in the municipality where we had the bovl and people came and I had to report the situation.	Meeting for the 625 signatories called to report failure in getting support
		People became upset	People were upset with private sector and public sector
		ideas came up and they said they will do it ourselves	People formed union to do it themselves
		One person suggested that we could call it a Broadband Union and another suggested DjurslandsNet and we ended up having the Broadband union Djurslands net	Name for the union (coop) finalized
		formed an intermediary board	Intermediary board formed
		the bovl out there	Bovl was the central reason the network

	So he ended up coming to a conference organized by the administrators and politicians in Djursland and he sat on the panel there and I was the chairman of the conference. When he started to talk about it, he said I may be the last cooperative (as a joke). The conference in 2002 made a step for us. At the first conference, the chairman was the director of the business community of Djursland. It was his responsibility to follow up on that conference but did not, so one or two months later. I was called for an activist conference. In the mean time we prepared even more technics and we had started to take signatures from people. People had to sign if they wanted to have cheap internet at home. We collected 625 signatures per household. We had all these signatures and materials at the activist conference. Then we had certain aims they were to expand the quality of citizens in Djursland, keep the citizens in town and draw in more citizens to Djursland to aid the tax net, this would curb rural urban migration, it would improve and grant employment, To keep businesses here in Djursland. Avoid youngsters leaving us forever. Keep and draw on tourist. These were the backbones of the points we created in 2001. This is important as we had an IT community of nerd, we had to shape them to have a social dimension and we could use all we know about		came about

	IT in our daily lives. It helped us form the points. We presented it at the activist conference. We had 23 point of mission, which we wanted the activist point to present to the Internet provider. We will not go for anything less than Broadband uplink and down link. We wanted to give a technical clue on what we were going for. We needed to be correct from the beginning. We made a big impression on the 40 people. So the director of the business community divided us into working groups. We wanted the Djursland business association to help us champion the course as they would be beneficiaries as well. This decision was important as we wanted the municipality involved as well. For us, we wanted it to be a Public private partnership. So I called on him several times and could not connect with him after the conference. In the middle of the summer, i eventually got hold of him. I found out that he had not even written down the role the activist would play. The conference, to them, was just a make believe thing and not an important thing. He was the director of the business community and he would have helped. All this month's we were in our workshop, 10 to 12 people trying to get the best knowledge. We had contact with parliament and the ministry of research and communications. And we		

	met all the time people, but the people did not really care because it was parliaments policy that telecom infrastructure community should be handled by the business community themselves (market). The municipality was not allowed to support the initiative as that would be interference. Hence it had to be handled by the market. At that time we met, the network providers and even TDC told us it could not be done. Hence the public sector could not help. It was strange to me that they said it should be handled by the competition and none in the private sector were willing to do it. They did not see the business sense in it. Then at that time, I had to report publicly to all those who had signed up on the outcome. The 625 people as time had gone by. So i called a meeting in the municipality where we had the bovl and people came and i had to report the situation. When people learned that our efforts were unfruitful. People became upset and ideas came up and they said they will do it ourselves. Someone suggested that we could form a union. One person suggested that we could call it a Broadband Union and another suggested DjurslandsNet and we ended up having the Broadband union Djurslands net. So we formed an intermediary board as we knew that we had to get everyone in Djursland involved. We sent		

	people to different communities to find resource people and that was the board's goal. I took the bovl out there to wherever they could find.		
Did you draw the network with the Bovl?	Yes, because it was developed 8 to 9 years earlier. People came from Aarhus from Silkeborg to our bovl. When we said we can be done, people trusted us. Even though they did not know how it could be done. The attitude in the bovl community was that we do things before we had a solution. This attitude was so pleasing to people who had a problem, hence there was trust. This helped us draw people. In Spetember 2001 we had major separations. We had a general assembly in the bovl hall founded the Djurslandsnet, the Broadband union. I could draw a lot of people because I had helped every kind of people within the 10 years. We had a lawyer helping us with the legal work, We decided that the union was not to be very decentralized in order to have local people involved, so that they could form their networks. So it had to be a union of several organizations. So already from the beginning.	Yes, because it was developed 8 to 9 years earlier.	Previous problem solving skills led the bovl to trust bjarke
		Even though they did not know how it could be done	No one had an idea of how the larger network could be facilitated
		The attitude in the bovl community was that we do things before we had a solution.	The bovl spirit led people to accept the idea
		I could draw a lot of people because I had helped every kind of people within the 10 years.	Personal contacts led Bjarke to attract people
		. We had a lawyer helping us with the legal work,	Legal advice sought
		very decentralized in order to have local people involved,	Decentralization adopted to foster equity
Were there threats from the network operators to stop you?	No, not on the open. However, in the organization part, we had 8 sub boards with each having 2 representatives in the bigger board. So we had 16 representatives from the boards to form how everything should be done.	No, not on the open	No threats from ISPs
		we had 8 sub boards with each having 2 representatives in the bigger board.	One central board, 8 sub boards
		So we had 16 representatives from the	16 man central board

		boards to form how everything should be done.	
How did you acquire the equipment?	We bought some of the antennas, but we fabricated some of the directional antennas. We opened it once and we found that there was nothing in it. So we duplicated it and had children from the technical school help us make more of it. We still bought directional antennas, but they were few. It made us save costs.	we fabricated some of the directional antennas	Ingenuity in antenna fabrication to save cost
Do you have a way of managing user experience?	We have volunteers in each area that connect the call the free volunteers. The volunteers know one another and can contact each rapidly.	We have volunteers in each area that connect the call the free volunteers.	Decentralized volunteer system adopted
Are your volunteers technical people?	Yes, some of them are, some of them are involved based on interest. Some have other jobs, but are connected online to monitor the network.	Yes, some of them are,	Technical volunteers
		some of them are involved based on interest	Non-technical volunteers
How do you monitor user payment?	First, they get a monthly bill, if they default they get a reminder. If they fail, they get disconnected from the central point.	First, they get a monthly bill	Subscriber monthly subscription
		if they default they get a reminder	Reminder for default subscription
		. If they fail, they get disconnected from the central point.	Non-payment-disconnection
What happens if a user decides to unsubscribe?.	The volunteers can take it down or they return our equipment. They get some of the excess money back. They sign a user agreement. When we had the organization, we wanted to have a pilot project in the town where we had the bovl, here we did a pilot test for ten individuals to be sure that the network works. We looked for important people in the town so that if it works, they will speak for itself. The subscriber	they return our equipment.	User returns equipment if he unsubscribe
		They get some of the excess money back	Partial cash for access refunded, if unsubscribed
		They sign a user agreement	Subscription agreement
		here we did a pilot test for ten individuals to be sure that the network works.	Pilot project to test run of 10 households the wireless idea
		Here I applied for EU money	Money from EU applied for
		, I got this money, 1.5 million dkk to make the next step	EU application successful

	network began in 2003, but in 2002 we had this project to test run the network. Here I applied for EU money because it was possible for few municipalities, we award municipalities in Denmark and Nordjurs was one of them. A citizen of Nordjurs, I got this money, 1.5 million dkk to make the next step. The first step was from our pocket, but the second step was to cover 10 villages with 400 subscribers with EU money. However, before embarking on this project, the ten household projects had to be done. I sought guidance from professionals within the wireless networks in Denmark. They gave us guidance and it was expensive. The result was that we had to buy equipment in their name to buy equipment for 12000 including moms, they did not kill our spirits almost. I had to reconsider the whole thing. If wireless was that expensive, we would have gone for fibre with the money, but the end user in the villages would not have been able to pay. It would not be a common network and only the rich would afford it. So we began the experiment with the 10 households. We ended up with the situation where I thought was still expensive, which was 2000 dkk access. So I thought we could think like this 1000 for each house for the house and 1000Dkk for the part of the infrastructure and 100 dkk a	However, before embarking on this project, the ten household projects had to be done.	Lesson for the 10 household project learnt
		I sought guidance from professionals within the wireless networks in Denmark	wireless expert advice sought
		They gave us guidance and it was expensive.	Wireless expert advice too expensive
		If wireless was that expensive, we would have gone for fibre with the money	FTTH mooted
		but the end user in the villages would not have been able to pay. It would not be a common network and only the rich would afford it.	FTTH sustainability was not clear hence dumped
		So we began the experiment with the 10 households. We ended up with the situation where I thought was still expensive, which was 2000 dkk access.	Access fee decided after 10 household project
		I thought we could think like this 1000DKK for each house for the house and 1000 for the part of the infrastructure and 100 dkk a month to pay for the ISP.	Potential demand makes it possible for 100 subscription fee
		Today, some of the networks have grown to reach the level where they do not pay the starting fee.	Most of the new fragmented network do not pay access fee again
		Then they take between 60 and 100 dkk a month.	Most new networks pay low access and subscription fee
		So the service is becoming cheaper.	Cheaper service-vision achieved
		The goal of all the unions today is still to provide accessible and affordable infrastructure.	Goal of affordable and accessible infrastructure on course
		The excess money is given to improve the infrastructure.	Excess subscription money used for infrastructure expansion
		If we pay anyone, the one	Few technical help

	month to pay for the ISP. Today, some of the networks have grown to reach the level where they do not pay the starting fee. Then they take between 60 and 100 dkk a month. Some have reduced the initial one time access fee to 6000 and 500 dkk in the beginning and then you pay 70 dkk a month. So the service is becoming cheaper. The goal of all the unions today is still to provide accessible and affordable infrastructure. The excess money is given to improve the infrastructure. If we pay anyone, the one is from a private firm to support us. For example, here in Grenaa the chairman after me Pernille is paid. Some of the supporters are paid in some degree and they are organized by the Djurslaand Broadband institute. They provide a specialized help and they are paid a certain amount of money for that and the private firm pays their employers. The volunteer and the employed people work together. The volunteer considers the professional as a help.	is from a private firm to support us.	outsourced
		. Some of the supporters are paid in some degree and they are organized by the Djurslaand Broadband institute. They provide a specialized help and they are paid a certain amount of money for that and the private firm pays their employers.	Staff on secondment are paid
		The volunteer considers the professional as a help.	Volunteers and professionals work together
Is the Grenaa chairman not a volunteer as well?	She is both a volunteer and a supporter as she is the director of the Djurslands Broadband Institute. The Djurslands Broadband Institute was designed for capacity building to teach people about how they can facilitate Broadband in their communities.	She is both a volunteer and a supporter as she is the director of the Djurslands Broadband Institute.	Some work as volunteers and paid staff
		The Djurslands Broadband Institute was designed for capacity building to teach people about how they can facilitate Broadband in their communities.	Coop has a capacity building institute
How did you attract more members?	We started a campaign with the slogan of fast internet at a cheaper price, this was	We started a campaign with the slogan of fast internet at a cheaper price,	Slogan fast internet cheap prices attracted people

	given to people, and interested people could sign in on paper or online. We collected more than 4000 free memberships. This made it possible to see that we would have the economy to raise the network.	interested people could sign in on paper or online	People signed on online and offline
		We collected more than 4000 free memberships	4000 memberships from the start
		This made it possible to see that we would have the economy to raise the network	Huge membership led to huge economy
Has ISPs moved in after the development of your network?	Yes	Yes	Commercial competitors are now in Djursland
. Do you have price segmentation?	No, they just pay for internet	No, they just pay for internet	Everyone pays equal price
Did you have topographical challenges when deploying the network?	Yes, but we had to look for the high places. We had to look for masts, roof tops. In the case of the mast, we needed to have agreements with the owner and most of the masts were not useful anymore. So we offer them free access to the Internet for donating the mast. There are hundreds of mast involved where we provide free internet and then spreads the internet to the area. In some cases, we put up a mast. It is a bit expensive. In two to three hand full of places, we have masts. For a friend in the bovl community who had lots of tree he did not want. He wanted to cut it down, but he then realized the antenna could be mounted here. We also used the hills to set up repeaters. We did not know how, but we had to think of how to do it and we found the way to do it.	Yes	Topographical challenges
		. We had to look for masts, roof tops	Roof s and mast for antennas used
		There are hundreds of mast involved where we provide free internet	Few masts were bought in addition
		who had lots of tree	Trees also used for antennas
		hills to set up repeaters.	Hills used for repeater stations
		. We did not know how, but we had to think of how to do it and we found the way to do it.	The usage of mast, hills and trees were learnt by coincidence
How did you plan the roll out?	In the Nordjurs supported by EU. The money did aid in buying equipment. We had to pay for starting internet	The money did aid in buying equipment.	EU money bought most equipment
		We had to pay the starting fee for access to the fibre	EU money paid for initial access to fibre

	connectivity. We had to pay the starting fee for access to the fibre as well as the traffic. So the EU money for the rural area was distributed to the benefit of all the rural areas. The first connected villages had a cheaper economy. Then we had a common account, so EU supported all of Djursland	as well as the traffic.	
		In the Nordjurs supported by EU funds	A small village in nordjurs connected first
Would it have been possible to do it without the EU funds?	Yes, actually we were not experienced with EU funding. We took the advice of people who supposedly knew about EU funding. However, we realized that they did not really know about it. We believe that when we were funded, we would wait for the money to come. When we talked to the EU office in Silkeborg, we were told that we should go ahead with the project and once the project is gone, the bill will be tabled by the EU who will refund 50% of the amount spent. And we did not know that earlier. So we had the 10 villages ready in groups and they expected 50 000 dkk for each of the villages and suddenly it became a lie. So I had to contact banks and they said no. I went outside to Aarhus and other places to meet the banks. The calculation was that the money each household will pay will make up half of it and the other half will come from the EU. Since we could not move as we could not get the money from the EU until after the project was done, then i went to the board of the municipality and told them the story. They agreed at the town hall that they	we were told that we should go ahead with the project and once the project is gone, the bill will be tabled by the EU	EU funding came late
		We took the advice of people who supposedly knew about EU funding.	Advice on EU funding
		When we talked to the EU office in Silkeborg,	Meeting at EU office
		the EU who will refund 50% of the amount spent.	EU money pays for 50 percent of amount spent
		So we had the 10 villages ready in groups and they expected 50 000 dkk for each of the villages	Villages grouped for implementation
		I had to contact banks and they said no.	No help from banks
		But the administrators of the municipality were not sure if this would be allowed by the government.	Municipality willing to sign surety but could not
		Then we got an answer which declared that this is not allowed as it had to be done by the market.	Copenhagen instructs municipality not to help
		I had written to the ministry to prove that we had contacted the operators and ISPs and they were not interested because it was not commercially viable for them.	Djurslandsnet protest that djursland is not commercially viable
		But they insisted that it should be done on a commercial basis and the municipality should not provide the guarantees.	Copenhagen insists, the market will facilitate the process

	will support it with municipal guarantee, so if the coop fails, the municipality would pay. But the administrators of the municipality were not sure if this would be allowed by the government. They sent the message to the ministry in Copenhagen. It took two years and by then the project had ended. Then we got an answer which declared that this is not allowed as it had to be done by the market. I had written to the ministry to prove that we had contacted the operators and ISPs and they were not interested because it was not commercially viable for them. But they insisted that it should be done on a commercial basis and the municipality should not provide the guarantees. PPP did not work when it came to the point it should work. We had to wait 2 years for a no. No one was willing to do it, and no one could do it and they still said no and all we wanted was for a guarantee and not money because EU would pay anyway as they had a contract with us. One day as I was on my way to the bank, I wondered what to do; I recalled that 3 people promised help. So I went to those individuals and I borrowed 2000 from the individual and from another 150 000 and from one individual 100000 and we had the level of money we needed guarantee for. We had the level of money to buy the connection out of Djursland and the equipment	One day as I was on my way to the bank, I wondered what to do; I recalled that 3 people promised help.	Three citizens provided loans
		We had the level of money to buy the connection out of Djursland and the equipment we started because the remaining money	The loan helped kick start the project
		the remaining money had to do with how many users we could amass to pay 2000 Dkk.	User subscription paid the remaining bills
		In the beginning they could not pay the money over time	Initial subscription hiccup
		But later they are now able to make payment.	Later people made payment

	we started because the remaining money had to do with how many users we could amass to pay 2000 Dkk. In the beginning they could not pay the money over time. But later they are now able to make payment. One of the new networks does not have beginning fee anymore. Part of being a cell that, could be 1000 for equipment and 1000 for part of the cell, so we could figure out expansion, so we could figure out the needs of the nodes as well as the needs for access. The money we received from the cell helped us expand. That was the concept of the economy.		
Did the EU finally pay?	Yes, when everything was done, everything was paid, we had this extra money.	Yes	EU finally paid
What were the phases you took in rolling out the project?	yes. The first phase was the pilot project with the 10 users; From the town hall mast we extended connectivity. We had 5 users around the mast and 5 users around the sports hall. We got the connectivity from ADSL. At that moment, we know that the model works and we could extend it. We had the challenge of learning how to route traffic. We learnt by experience as we had a lot of downtime in some sections.	The first phase was the pilot project with the 10 users	Project was implemented in phases
		At that moment, we know that the model works and we could extend it.	Wireless organization model sustainable
		We had the challenge of learning how to route traffic.	Had to learn traffic routing
		We learnt by experience as we had a lot of downtime in some sections.	Network management- learning by experience
When did this stabilize?	We had to learn by experience, we taught what it took to make the traffic stable. I had a hand on approach. We had this local board filled with people who wanted to decide or have	We had to learn by experience, we taught what it took to make the traffic stable.	Learnt traffic management by experience
		I mobilized my 12 bovl group who were formed to support me. So when anything is expected of me,	Core decentralized action team working with bjarke

	influence, and then we had the volunteers who were technically minded. We had some volunteers who wanted to control as well if they were technical as well. So we had these troubles too. Actually, in the 16 man board, since the beginning and long into when we built the network, the members wanted influence. In some way or the other they managed to impress me that it was my responsibility to make everything happen. SO between every board meeting, which occurred between every forth night initially and later every month. They expected that between the meetings, I would make certain things happen in terms of solving problems. So we decide that Bjarke should do this and that. So I mobilized my 12 bovl group who were formed to support me. So when anything is expected of me, they helped me. The group had to grow as the board wanted many things to happen. So the practical group grew to 20 people between 2001 and 2004. It is important to understand how they work. These 20 were employed through the public system, so they were not all really volunteers. We had people from public works etc. So the arrangement would be something like, if the person works on with you for 6 months, after 6 months you have to start paying him or her. So we had to replace people after every 6 months, but in the	they helped me.	
		and then we had the volunteers who were technically minded	Core action team, part volunteer, part paid
		if the person works on with you for 6 months, after 6 months you have to start paying him or her. So we had to replace people after every 6 months, but in the practical sense,	Payment of action team not sustainable
		there were no jobs and for the social workers, they could gain work experience by working with us.	Coop provided working experience to people
		We have a lot of IT support apprentices who work for us voluntarily.	More voluntary IT personnel
		We had the board	A board is formed
		we had the technical actors,	Technical actors
		the central organs	Central organ
		Working Groups	Working group
		For some reason people did not know that the group working with me were not under any form of wages.	Misconception of number of people paid-problem
		That gave us some communication trouble which ended up disintegrating the unified network to the standalone networks.	Fragmented board still coordinate

	practical sense, we had to extend their stay with us. I agreed to these arrangements and I had them for a time. Later we had a meeting with these people and told them we could not pay as we were not ready to pay wages. Later we had to pay only one of these external persons, from the project. This was because there were no jobs and for the social workers, they could gain work experience by working with us. We have a lot of IT support apprentices who work for us voluntarily. We had a problem with communication. We had the board, we had the technical actors, we had the central organs and the working groups. For some reason people did not know that the group working with me were not under any form of wages. That gave us some communication trouble which ended up disintegrating the unified network to the standalone networks. They thought that money they (various boards) were used to pay wages for the 20 people, whereas only one of them was paid 1/3 of the wages.		
How did you choose the board members?	In Denmark, unions are common. We have a union law which means they should be democratic. There should be an annual meeting where everyone has a voice. Everyone had a right to put something on the agenda. So majority carries the vote. This is standard for unions in Denmark. Fascist	We have a union law which means they should be democratic. There	Union operation is democratic
		was to decentralize the treasury.	Treasury was decentralized
		So I was in the minority with my idea of having a central pool for the money.	Effort to unify treasury brings problems
		They had to stop sending the money to the centre	No money sent to the centre afterwards
		We bought the equipment	Money at centre was

	organizations are not permitted in Denmark. If you do it another way then you have to form a firm. But the crucial thing is that one thing i did wrong was to decentralize the treasury. I was also at the cashiers meeting. I had just hired the cashier of Norre djurs as the co-worker in the center, the same person who ended up with 1/3 of the wages from the project. When I said, I think that we should put out bills to every household in Djursland from the centre. She objected to it. She said it will not happen when she was around. There was silence in the room. Then one of the other cashiers she tried to put water on the conflict. We could save the portal if we go out with the bill and then we could hear what they have to say, and then we could decentralize collecting the money. The other cashiers found it interesting and the new employee, was satisfied and wanted to be involved in her own area. So I was in the minority with my idea of having a central pool for the money. This situation, of just 5 mins, made the whole difference. When you decentralize collecting money you decentralize the group. So anytime there is a conflict, the decentralized groups can split easily. There will always be a conflict. You can decentralize anything, the organizing, support, maintenance, project group but not the money. The	based on where on where the money comes from and it was fortunate for us to do that.	used to purchase equipment
		We at the centre could not connect to the customers as we did not have their addresses;	There was disconnect between centre and end customer
		. The advantage of a decentralized board is on the level of support, technic, and organization.	Every aspect of the board was decentralized

	moment the money is decentralized there will be no common organization. They had to stop sending the money to the centre. We bought the equipment based on where on where the money comes from and it was fortunate for us to do that. That made deployment cheaper. We at the centre could not connect to the customers as we did not have their addresses; their individual boards were much closer to them hence had to manage things. The advantage of a decentralized board is on the level of support, technic, and organization. On the level of decision and the economy, there should be a central board to decide. We needed 16 staff to be waged, but now it is difficult to employ people even at the networks. It is a lousy network compared to my dream of building a strong robust and sustainable network.		
What role did the government really play in this project?	I mean, when the network was a success, we had support from the political and administrative level. We were known to be trustworthy. However the political, business and administrator are not planning for the long run. They have other agendas. When it becomes hard, they are not there. That is why it is not good to build your abilities on this relationship. I was given the honor of being the cultural person of Nordjurs. I was honored with flowers and music. It	I was given the honor of being the cultural person of Nordjurs	Recognition from political and administrators on success

	had no bearing afterwards. It was correct of them to give me and my group this honor. But when it becomes difficult, they criticize. The municipality was interested. But from Copenhagen, the support was not there		
Would you say there were regulations that helped you?	The free spectrum aspect is a regulation of 2.4 GHz exist in many countries and it helps	The free spectrum aspect is a regulation of 2.4 GHz exist in many countries	Free spectrum was a huge incentive
Do you pay tax from the subscriptions?	Yes, but if you buy the tools to do a project, you can have the VAT refunded. But when you do the project, you have to pay the VAT, but get a refund for buying of the tools and the tools should be in working condition. We get refunds of VAT. But from subscription we pay 1/5 tax. We would have loved it to be VAT free. Even though we were a union, we had to be registered as firms. The state does not care if you don't get profit. We were not considered as a cultural organization so we were not free from tax.	but if you buy the tools to do a project, you can have the VAT refunded	Tax refund on equipment-general law
		But from subscription we pay 1/5 tax	Pay tax on subscription
Is there a competition from ISPs who saw your model and decided to compete?	When we consider the economy of these possibilities, to have cheap Broadband you need a telephone contract from TDC. When you consider the economy, I do not think they can compete because they will run at a loss. They will have a good downlink, but less uplink, which is not good. We deliver much better upstream speed and you can do that with fibre. And fibre is very expensive. They can deliver in Grenaa center, but not here. If 45% of the household agree, they will put down the fibre and that is a challenge here. I do	They can deliver in Grenaa center, but not here	Aside cities no direct competition

	not think I will see it in my lifetime.		
Why not WiMAX?	It was very expensive. Skyline here in Denmark did not succeed. They need much more equipment	It was very expensive.	WiMAX expensive
Did you consider the role of CPEs and if the users could afford it?	We based our solution of stationary computers. We used USB Wi-Fi boxes at the initial stage. Many had no laptops by then. USB meant they needed a driver. Many were not able to install their drivers; our people would have to send people out there. Later we had a network box that would not need the user to get a driver. So we customized a network box with no driver. We had a lot of trouble of double IP address with the automatic boxes. So we had to develop an instruction manual for them.	based our solution of stationary computers	Users could afford CPEs
Are the different networks operating in a different way?	Yes, the still following the same concept.	Yes, the still following the same concept.	Splintered networks are organized in the same way
What really triggered the conflict that broke the network?	It is really strange. But it is a very important knowledge. I planned this network in a way that you have the network, you have the village. When I planned the network, we had extended it with Wi-Fi. We delivered 11mb bandwidth was redistributed to the users. If we had 10 to 20 users in the network, we could cope with the bandwidth, but we had to grow to be able to pay the bills. So we had fluctuations in traffic time. The quality of service was low and people felt bad because they had paid 2000 Dkk for them. We	We delivered 11mb bandwidth was redistributed to the users.	Initial low bandwidth led to break up
		The quality of service was low	Poor quality of service led to break up
		people felt bad because they had paid 2000 Dkk for them	High cost for low quality of service led to break up
		We knew that the G standard in special issues and it was dangerous to buy the special issues; we had to wait for the stable standards.	Failure of upgrade to G standard led to break up
		. Its cost was 1100DKK per subscriber a month to the ISP.	The adoption of expensive ADSL led to break up
		So we had to get rid of the	The ADSL

	knew that the g standard in special issues and it was dangerous to buy the special issues; we had to wait for the stable standards. This would provide 54 MB bandwidth. I was not fearful of this. The moment it was standardized, we bought the equipment and then we had a very disturbing experience because then we realized that it was not providing the data rates we expected. We had fewer throughputs, so we had to put up the g standard and we had changed a lot of the links. It turned out that the 54MB can only be achieved on a short distance and not in the massive network we had. It is the same spectrum of 2.4 to 2.5, which implies that the frequencies are modulated higher. It meant we had to grow still on the b standard. So at this time, the temperature was rising, i started to go to the different ISPs to look for a solution, I wanted to get them to have a contract with us as a local service provider to the entire network and not as a customer, so we could have the opportunity to share their 2MB connection except cybercity. They agreed and we made a contract. The contract made us able to share the user connection of ADSL; we had agreed with local people where they lived in a place where they had access to ADSL. The problem with ADSL was that if you are out few km from the centre, the data rates reduce. The signals	DSL. So came the problem. The money that should have come from the monthly bill which would have paid for the equipment, the money was used for the agreement with the ISP in the short term.	agreement exhausted the funds, led to breaking point
		People did not understand where the money was going.	Lack of transparency on the ADSL decision led to break up
		H standard showed that it was better, it showed that we could save 80000dkk a month to the ISP	H Standard showed more promise and saved cost
		People could not put the information together; even those actively involved said this cannot go on.	Lack of information on the upgrades led to the break up
		People did not understand where the money was going.	The unilateral decision to upgrade to H standard broke up the network finally

	fade out 5km from the centre because the modulation can't stay alive. My idea was to get 2mb ADSL and an extra bandwidth from the ISP and blend it with the fibre. So we have 2mb from the ISP and supplement it with 2mb from the fibre. So that we could intermediary have high enough speed. So we set up 16 ADSL and travel around the network and told them that they will get it for free. This solved the problem temporarily as I waited for the H standard. Equipment for the H standard was hard to make, here we had another frequency so the modulation was better. The moment we put up on our long distance link, this was May 2004, and we set up the first equipment. It was very successful. It could measure more than 70MB at point to point. So we had to get rid of the DSL. So came the problem. The money that should have come from the monthly bill which would have paid for the equipment, the money was used for the agreement with the ISP in the short term. Its cost was 1100DKK per subscriber a month to the ISP. It was People did not understand why the money was going. So when the H standard showed that it was better, it showed that we could save 80000dkk a month to the ISP. People could not put the information together; even those actively involved said this cannot go on. So it came from my lacking ability to realize that we could not		

	cope with g standard. If g standard had worked, then no problem would have occurred. We could not calculate the unknown. If this had not happened, then people would have said, this is not what we were promised, so it would have collapsed. So to me it is very important that people did not understand the decision.		

Appendix E .1.2 Open coding for Hallaryd Broadband Coop

Interview Questions	**Responses**	**Paragraphs, Words, Phrases and sentences from interview responses**	**Open codes**
What is your coop all about?	There was a meeting with the kommun, there were gathering all the rural associations, at that time I was not on the board and I did not know much about it. Suddenly we got a paper in the mail that in 2020 the telephone lines will be put down, because there is new technology and they have not been updating the existing service station. We were offered Fibernet instead, so we had to make the association with all the work and extra cost. The kommun did not want to put the effort into it or did not have the possibility to do so they put it up in the deference there was a young couple who were very eager to get started, so they had a meeting in march 2012. And then I was the one of those that volunteered, so we started a working group, so we sent out an interesting note so that people could sign up. Everyone got the notice about the telephone line that would be put down and everyone realized that we needed to have some form of communications in many parts here, the mobile	There was a meeting with the kommun	Kommune the initiator
		there were gathering all the rural associations	Kommune in search of rural associations
		Suddenly we got a paper in the mail that	Association informed residents by mail about initiative
		in 2020 the telephone lines will be put down,	No telephones by 2020 – why you should join- need to communicate
		there is new technology and they have not been updating the existing service station	New technology replaces telephone – why you should join- need to communicate
		We were offered Fibernet instead	Fibre touted as better option
		so we had to make the association with all the work and extra cost	Call to form association
		there was a young couple who were very eager to get started, so they had a meeting in march 2012	Young couple organized a meeting in 2012

	telephone is not working so good. Many of the young people were interested in having it elderly people that were fine with their mobile phone, they can cope or maybe do not have money to put 25k into the project to have internet.	then I was the one of those that volunteered	Individuals joined
		we started a working group	Working group formed
		so we sent out an interesting note so that people could sign up	Working group began organizing people
		Everyone got the notice about the telephone line that would be put down and everyone realized that we needed to have some form of communications	More people invited by working group
		the mobile telephone is not working so good	Poor mobile service emphasized
		young people were interested in having it elderly people that were fine with their mobile phone, they can cope or maybe do not have money to put 25k into the project to have internet	More young people than elderly signed up
Is there an amount you have to pay upfront?	Yes, we have to pay the digger for the materials needed in the project.	Yes, we have to pay the digger for the materials needed in the project.	Coop raised money to pay digger for right of way
You have an association and the board and the kommun approached you?	Yes, the first association was Hallryd but they were not able to provide information, so a new board was formed. I do not know how the young couple was connected from	Yes, the first association was Hallryd	The old board were not able to provide concrete information
		, so a new board was	A more active

	the start, maybe they had been to the commune earlier. When the working group started more people joined up. A lot of competent people joined the working group. One is the individual that made the homepage hallaryd.se. He has put a big lot of work into the project as he is in the planning group. We found that there was enough interest to get contributions then we decided to create the fibre association. Due to the contribution, if we had more than 200k euro, we had to make a common purchase and just to state that the contribution because we counted on how much we had to have in contribution, we had to part Hallryd parish in 4 pieces we had too much digging work to do and we had to stay below 200k euros. So we have 4 different associations just for Hallaryd.	formed.	board was formed
		When the working group started more people joined up	More people signed up
		A lot of competent people joined the working group	Working group, an assembly of competent people-voluntary
		enough interest to get contributions then we decided to create the fibre association	Volume of potential interest led to the metamorphosis of association to fibre association
		Due to the contribution, if we had more than 200k euro, we had to make a common purchase and just to state that the contribution because we counted on how much we had to have in contribution, we had to part Hallryd parish in 4 pieces	To avoid procurement for digging, the association broke into 4- cost savings
		Due to the contribution, if we had more than 200k euro, we had to make a common purchase and just to state that the contribution because we counted on how much we had to have in contribution, we had to part Hallryd parish in 4 pieces	200k for one organization was not enough, hence it had to be 4
Is it because it is	No, because it is more	No, because it is more	The population Is

popular?	expensive, there are large spaces without houses; hence we need much money to contribute.	expensive, there are large spaces without houses; hence we need much money to contribute.	dispersed so having one organization would be too costly
If it is more than 200 000 Euros what happens?	Then you have to go for procurement. We do not want to have polish diggers; we need local diggers who know the area	we need local diggers who know the area	Local diggers were preferred to create jobs
How many people are in one association?	35 , 40 up to 50 members in each, some members have more than one connection, ex we have two houses, then if we have 50 houses, there will be about 55 connections. 25 000 SKK for each connection. For example, in my house, I pay 50 000 for connection	35 , 40 up to 50 members in each	35 to 50 member to an organization
		some members have more than one connection	Some members need more than one connection
Which of this 4 association relates to the commune?	They have 2 from the start and from the start they had people on the 2 boards and they shifted the chairman. We do the same, and they belong to each board as well. There is a common secretary and common treasurer. That is me. I have a lot of jobs in terms of payment, invoices etc.	they had people on the 2 boards and they shifted the chairman. We do the same, and they belong to each board as well. There is a common secretary and common treasurer. That is me. I have a lot of jobs in terms of payment, invoices etc.	Shared organization management
How far is the project?	They have already started; I have issued the first invoice, now i am waiting for the money.	They have already started; I have issued the first invoice, now i am waiting for the money.	Project on the way
How did the people in the community accept the network and	They want a good telephone connection; they can also have the internet and tv. If you are elderly you can have	have the internet and tv	Internet tv and internet- peoples need

what are they looking forward to?	a security alarm. I do not know the cost.	are elderly you can have a security alarm.	Elderly alarm-demand aggregation
How about right of way?	You can go to the lands commission. To get the connections right, but that costs, In the contract with the members, they are expected to allow the digging on their land.	In the contract with the members, they are expected to allow the digging on their land.	Members allow digging on their lands –right of way-digger cooperation
But are people positive to digging?	Yes,	Yes	People positive to digging
Are they receiving money for digging through their land?		No. they get the honour to say I have a fibre cable in their land	People not paid for digging on their land-user acceptance and cooperation
When will the fibre get here?	Late summer	Late summer	Fibre expected late summer
When do you hope to see the digging completed?	November, we have to cost and contribution shall be exhausted by the end of the year	. November	Digging completed nov
In what way are they helping ?	the paid invoices before getting the money and fibre blowing and also the connection at the house with the operators. So that part we the association gets money from the members and we pay for the cost	and fibre blowing	Commune pays for fibre blowing upfront
		the paid invoices before getting the money	Coop reimburses commune upfront payment
Do you have any working model because this is infrastructure is	Well,the agreement with the commune is that the commune maintains it, as long as the net is used, the	,the agreement with the commune is that the commune maintains it	Commune maintains the entire network

yours do you have a model on how to sustain it?	operators providing the services will tell us who uses the net and at which time and the members pay us and we pay the providers. Because they will charge us for the cost	operators providing the services will tell us who uses the net and at which time	Operators tell the coop who is using the service
		pay us and we pay the providers	Coop gets service bill from member to pay operator
Do you have an idea on what they will pay?	It is up to the members on which services they will use as there are different services and data capacity. We pay 8000 SEK per month to municipality	We pay 8000 SEK per month to municipality	Coop pays 8000 skk per month for access to commune fibre
Are you all volunteers?	Yes, we get EU money for associations working along with all sorts of projects, we have some money during the consultation and information part as we still have to inform people as we work.	That is the problem, you do not get the contribution at hand, you have to pay, then you show the invoices and then you get the money.	Eu funds cover part of digging cost
You don't depend on EU fund?	No, cos we have the 200skk each year. We think this year there will be coffee for meetings. Otherwise, there would be more administrative costs.	we have to pay 20 000 Skk	5k upfront and 20k later
The EU funds pay part of the digging cost?	Yes, we have to pay 20 000 Skk. We have the goal of 25Skk. If it is less that is good. We have the waiting list so if it is possible to get the members on a durable cost that will be fine how much does it cost per line kommune pays for materials. Total cost for each association is about 1.9million SKK or thereabout.	Total cost for each association is about 1.9million SKK or thereabout.	1.9million sek cost for association

Do you chose the diggers?	Yes, we find the diggers	Yes, we find the diggers	Coops choose the diggers
Who does the quality assurance?	There will be some kind of control at sight, they will look at it, when you are going to blow the fibre, if the pipe is bent, and you can't blow it. If they don't get it right then they have to make it right.	There will be some kind of control at sight, they will look at it, when you are going to blow the fibre, if the pipe is bent, and you can't blow it. If they don't get it right then they have to make it right.	There is quality control on digging
Do the diggers have any education?	They must have	They must have	Diggers must be educated
Do you meet to choose the diggers?	Yes	Yes	Coop sources for the diggers
For the association do you have tenure for the executives?	Yes, 2 years and the possibility to be re-elected, you can also drop out and they will have an extraordinary meeting to note a new exec. In May, we will have the annual meeting and all the four will come together.	Yes, 2 years and the possibility to be re-elected	Elections occur every 2 years at annual meetings
		In May, we will have the annual meeting and all the four will come together.	The meetings involve the four organizations in may
How do you intend to keep the people informed?	home page, the meetings, before the start of the digging we had a meeting, we sent out a mail with the membership fee. We were to put an advert but forgot, but still more people came.	Our home page,	People are informed via website
		the meetings	People informed via meeting
		we sent out a mail	People are informed by mail
		We were to put an advert	People are informed by

			newspaper ads
Are people enthusiastic about the service?	Well, we have to wait, we have tough people. There was a problem at the start when there was a school at Hallaryd where the school was to have internet they put a mast, and they got radio signal to the mast to the station. On an occasion where there was an extra place for more people to have it, the ADSL I was one of the people lucky to be connected but is would not be as good if I had mobile connection here. The young people they have connection, called nets x in their marketing they say they are the best, but you have to stand outdoors to get 1 MB, in a good day you have 3 MB and on the weekday, it fluctuates, but with the ADSL I have 5 to 6 MBs that is why I need fibre net for a better connection.	Well, we have to wait, we have tough people	There is enthusiasm about the service
Does the association have an office?	No, we gather about 7, 8 9 of us, we host at member houses and they provide coffee and cookies. There is no administrative cost there as that is more of a social thing. People are grateful in the parish for the good work. The association is like 4 companies and we have 4 treasuries. I have connections with the tax authorities, and the authorities. If something is changed in, the board, we have to go to the association that register companies and	We gather about 7, 8 9 of us, we host at member houses and they provide coffee and cookies	Coop has no office, meet at member house on rotation

<table>
<tr><td></td><td>many other agencies.</td><td></td><td></td></tr>
<tr><td rowspan="3">You are quite far?</td><td rowspan="3">We are almost done. We were lucky because of the agriculture programme from EU runs from 2007 to 2013 or 14 and the new programme was delayed so 2014 was likely no money, we were lucky to get the last piece of the button. We were lucky because we had to wait and you don’t get the money in 2014 in our contract we hoped for 2013, to make sure people do not drop the interest, we slated the completed date for 2015, so people would not ask their money back. We were lucky. We had the help from fibre handbook on how to form associations, it helped us</td><td>were lucky because of the agriculture programme from EU</td><td>Funds from EU agric programme</td></tr>
<tr><td>so people would not ask their money back</td><td>Prompt work to gain people’s confidence</td></tr>
<tr><td>fibre handbook on how to form associations,</td><td>Fibre handbook helpful in running coop</td></tr>
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Appendix E. 1.3 Open Coding for Magnolia Road Internet Coop

Event	Paragraphs, Words, Phrases and sentences from interview responses	Open codes
PeakNet forms, opening free internet kiosks in Nederland.	PeakNet forms, opening free internet kiosks in Nederland.	Peak net begins operations
Bill Clark starts Sugarloaf.net (SL.net), providing T1 speeds via low-power radio transceivers.	Sugarloaf.net (SL.net), providing T1 speeds via low-power radio transceivers.	Sugarloaf provides radio Internet
Mountain Ear reports on 60 people attending a Peak-to-Peak Healthy Community Project (PPHCP)meeting on high-speed Internet access alternatives.	Peak-to-Peak Healthy Community Project (PPHCP)meeting on high-speed Internet access alternatives.	PPHCP moots on internet access to communities
George Watson sets up his wireless LAN and dreams of faster access.	George Watson sets up his wireless LAN and dreams of faster access.	George Watson tests radio network at home
Rob Savoye of PPHCP's High Speed Internet Project starts Magnolia discussion with Greg Ching.	Rob Savoye of PPHCP's High Speed Internet Project starts Magnolia discussion with Greg Ching.	Rob Savoy begins talk with Greg Ching
Allen Schmitt-Gordon and Paul Kolesnikoff join the discussion on how to bring PPHCP's project to Magnolia.	Allen Schmitt-Gordon and Paul Kolesnikoff join the discussion	Allen Schmitt-Gordon and Paul Kolesnikoff join
Rick Cobb asks his neighbor George Watson about his home wireless network.	Rick Cobb asks his neighbor George Watson about his home wireless network.	Rick Cob asks George Watson about his network
George Watson tests reception at Rick's house. Rick fantasizes of working from his porch connected to the Internet via George's network and ISDN line.	George Watson tests reception at Rick's house.	Watson connects to Rick Cob
George Watson thinks an upgrade	George Watson thinks an upgrade to	Watson thinks an

to a T1 connection would be required to handle multiple subscribers to his wireless network. Preliminary inquiries are made to determine if we can find 4-5 subscribers willing to share the cost of a T1.	a T1 connection would be required to handle multiple subscribers	upgrade will accommodate more people
Greg Ching and Allen Schmitt-Gordon express interest in the project.	Greg Ching and Allen Schmitt-Gordon express interest in the project.	Greg and Gordon express interest in project
Invitation to join MRIC goes out on PUMA e-mail. Conversations begin between MRIC and NedNet/PeakNet.	Invitation to join MRIC goes out	Invitation sent to more members
T1 provider shopping begins	T1 provider shopping begins	Search for ISP (T1 provider)
MRIC founders meet for the first time.	MRIC founders meet for the first time.	MRIC is formed
Conversations between MRIC and SL.net begin.	Conversations between MRIC and SL.net begin.	Search for Possible Synergies
Second meeting to review design. Propagation drive around tests with GMRS handhelds.	Propagation drive around tests with GMRS handhelds.	Propagation test done
State Representative Tom Plant offers to seek funding for a pilot project.	State Representative Tom Plant offers to seek funding for a pilot project.	Tom Plant promises State funding
Collected GPS data for 34 potential subscribers.	GPS data for 34 potential subscribers.	GPS locations generated
www.magnoliaroad.net up and running.	www.magnoliaroad.net up and running.	Website developed
PUMA newsletter article on MRIC draws interest of new	PUMA newsletter article on MRIC draws interest of new group of	Invitation via Puma news article

group of potential subscribers.	potential subscribers.	
mric-community Yahoo! group set up for announcements/discussions.	mric-community Yahoo! group set up for announcements/discussions.	Invitation via Yahoo groups
Meeting with Tom Plant & NedNet/Peaknet regarding grant.	Meeting with Tom Plant & NedNet/Peaknet regarding grant.	Discussion with Peaknet
George Watson reports 5 Mbps from 1/4 mile away using standard PCMIA card antenna.	George Watson reports 5 Mbps from 1/4 mile	George Watson reports 5mbps test from ¼ miles away
Tom Plant takes grant proposal to committee.	Tom Plant takes grant proposal to committee.	Tom Plant submits application for state funding
MRIC flyer left at PUMA potluck.	MRIC flyer left at PUMA potluck.	MRIC flyers at Puma Pot luck
Decision made to use Fortis Communications as initial T1 service provider. T1 end-point and repeater tower at John Carder's house.	Decision made to use Fortis Communications as initial T1 service provider.	Fortis communication chosen as T1 provider
Planning meeting at George Watson's house. Incorporation papers signed. Less expensive tower design in progress due to lack of state funding. Prep work needs to be done prior to pre-PUMA meeting at Greg Ching's house on Nov 1. Over 50 potential subscribers; need to set up new Yahoo alias to push news out to them.	Incorporation papers signed	MRIC incorporated
Rick Cobb orders a portable telescoping tower and base for testing signal strength in preparation for a demo prior to the PUMA meeting at Greg Ching's	Rick Cobb orders a portable telescoping tower and base for testing signal strength	Rick Cobb orders portable tower for more testing

house at 6:00 on Nov. 1		
First public demo of 802.11b connection between George Watson and Greg Ching's houses (roughly .9 miles with NO direct line of sight between the two points). Rick Cobb, Pablo Sanchez and Ray Browning helped with mobile tower set-up (using $90 antenna). 11 Mbps link demonstrated running for over 2 hours. More demos planned before upcoming PUMA meetings (next is Saturday, Dec. 15th). Broadband fever detected amongst those in attendance.	First public demo of 802.11b connection between George Watson and Greg Ching's houses (roughly .9 miles with NO direct line of sight between the two points).	Greg Ching provides his house for test
Portable tower and base received; George Watson begins configuration.	Portable tower and base received; George Watson begins configuration.	George Watson configures base station
Second portable tower and base ordered for point-to-point signal testing.	Second portable tower and base ordered for point-to-point signal testing.	Another test is made by George Watson
Successful mobile tower testing at HCFD #4 and George Bogg's house confirms connectivity to George Watson's repeater tower. Pine Glade & Magnolia to Frontier & Hazelwood is no problem! Need second mobile tower assembled for missing link to Porter Ranch. Ray Browning, Scott Browning, George Boggs, Greg Ching, Rick Cobb, Alan Dunwell, Craig Irwin, Ric Turley, Pablo Sanchez, and George Watson participated in this field test.	Successful mobile tower testing at HCFD #4 and George Bogg's house confirms connectivity to George Watson's repeater tower	Successful test
Initial testing between Porter Ranch and Twin Sisters did not	testing between Porter Ranch and Twin Sisters did not result in a good	Fourth test between Porters ranch and Twin

result in a good signal. However, in the process of setting up the PUMA potluck demo we may have found a location to reach Porter Ranch. Thanks go to Mary Jo Brodzik, John Chase, Greg Ching, Rick Cobb, Bob Gailer, Paul Kolesnikoff, John McClellan, Dan Metzger, Hans Rohner, Pablo Sanchez, and George Watson for braving the sunny cold (Ray Browning's perfect tower raising attendance streak ended at three as he shreds Winter Park; he's still batting .750). This was the first time we used both mobile towers! We promise to be faster next time....	signal.	sisters fail
Good turnout at the PUMA potluck gave MRIC a chance to explain our Broadband plans. Using an unamplified connection with heavy snowfall we were able to sustain a 5 dB signal (still 700 kBaud or 20X typical Magnolia dial-up speed) for perhaps an hour before the signal degraded. At least one person offered to write a check to MRIC! Thanks to Greg Ching, Rick Cobb, Hans Rohner, Pablo Sanchez, Paul Kolesnikoff, and Ric Turley for setting up the Rohner-McClellan link. Special thanks to our hosts Roz and John McClellan who really helped *promote* our presence!	at the PUMA potluck gave MRIC a chance to explain our Broadband plans.	MRIC explains idea at puma pot luck
Braving rain and snow, two teams installed a few more antennas. In one very difficult (sunken) location, an amplifier was required to get a good signal 1.4 miles away. In another situation	Braving rain and snow, two teams installed a few more antennas. In one very difficult (sunken) location, an amplifier was required to get a good signal 1.4 miles away.	Second public test under snowfall

2.12 miles from a repeater, a very strong signal was received without any amplification. In the latter case, over 90% of the packets transferred were at 11 Mbps during "white-out" snow conditions! Both locations verified by laptops surfing the web.		
MRIC board meeting at Greg Ching's house. Discussions continued on incorporation issues and initial trial subscribers. Immediate goals are to finalize by-laws and create repeater tower hosting agreement, subscriber agreement, and promissory note (for repaying seed money loan).	Immediate goals are to finalize by-laws	Board members had their meeting to make by-laws
Bulk purchase of network cards and antennas in progress.	Bulk purchase of network cards and antennas in progress.	Bulk purchase of equipment made
Braving gusty winds and chilly weather, two legs of the Magnolia Golden Triangle were tested successfully. From Winiger Ridge to Twin Sisters we got a 33 dB signal! From Winiger Ridge to Porter Ranch we got an amazing 41 dB!! Thanks to John Carder, John Chase, Greg Ching, Rick Cobb, Alan Dunwell, Mark Lindberg (from Wondervu), Dan Metzger, Mike Morrissey, Hans Rohner, and George Watson.	Braving gusty winds and chilly weather, two legs of the Magnolia Golden Triangle were tested successfully.	First successful installation under gusty wind
Board meeting at Rick Cobb's house. Decision made to start the trial on April 1st (no fooling!). George Watson has found a way to modify ORiNOCO AP-1000 into repeater station wireless routers, saving MRIC $300 per	George Watson has found a way to modify ORiNOCO AP-1000 into repeater station wireless routers, saving MRIC $300 per repeater station.	George Watson modifies routers to save cost

repeater station. Pablo Sanchez will place the order for the T1 line this week.		
At least 30 people brave winds on a sunny day to witness the MRIC ribbon-cutting. Special guest Paul Farnan from Congressman Mark Udall's office attended. Lots of shrimp, pate, and wine!	At least 30 people brave winds on a sunny day to witness the MRIC ribbon-cutting.	First official trial made
Alan Dunwell becomes the first person to write a $300 seed capital loan to MRIC even though he will not be ready for the initial trial! He is joined by over a half dozen lenders who agreed to no-interest MRIC promissory notes. Thanks again to our demo hosts Jim and Todd Cowart!	Alan Dunwell becomes the first person to write a $300 seed capital loan to MRIC	Early subscribers provide 300 dollars seed capital
Taggart & Associates reports insurance success!	Taggart & Associates reports insurance success!	AIG insurance application successful
Board decides to order Fortis connection (as earlier attempt stalled).	Board decides to order Fortis connection (as earlier attempt stalled).	Fortis provides backhaul connectivity
At least 30 people brave winds on a sunny day to witness the MRIC ribbon-cutting. Special guest Paul Farnan from Congressman Mark Udall's office attended. Lots of shrimp, pate, and wine!	witness the MRIC ribbon-cutting. Special guest Paul Farnan from Congressman Mark Udall's office attended	Congress man cuts sod
50% attainment of $15,000 seed capital goal via $300 loans.	attainment of $15,000 seed capital goal	$15000 dollars raised
50% attainment of $15,000 seed capital goal via $300 loans.	via $300 loans.	$300 loans from members
Out of 39 trial subscribers, 22 active users. Remaining 17 still	Out of 39 trial subscribers.	39 trials

completing installations.		
22 active users	22 active users	22 subscribers
Don Roper becomes our first summer resident subscriber by paying 3 months in advance.	Don Roper becomes our first summer resident subscriber by paying 3 months in advance.	Customers sign up
MRIC merges wit Supar loaf	MRIC merges wit Supar loaf	MRIC Merges with Sugarloaf
MRIC merges with other smaller coops	MRIC merges with other smaller coops	MRIC merges with other smaller coops
MRIC did not qualify for state funding as their total expenditure was below $100 000	MRIC did not qualify for state funding as their total expenditure was below $100 000	State funding failed
Replacement of the network backbone with higher speed Trango 5.8Ghz gear begins	Replacement of the network backbone with higher speed Trango 5.8Ghz gear begins	Equipment upgrades

Appendix E.2: Open Coding Process for Developing Countries

In this process, Open codes or concepts are extracted from Paragraphs, phrases, sentences and words of the respondents from the developing country cases that were interviewed.

Appendix E.2.1: Open codes for the Johannesburg Wireless User Group (JAWUG)

Interview Question	Response	Paragraphs, Words, Phrases and sentences from interview responses	Open codes
History of the coop?	JAWUG started initially in 2001. The initiator was Kieran Murphy. It started from a community network with people living in the same street. They connected to each other via Wi-Fi to see how far they could push it. They started from the East of Johannesburg at the same time other similar smaller networks were popping up around Johannesburg. In 2006 there was an interconnection that connected the splintered Wi-Fi networks into one bigger network. This is the origin of JAWUG.	JAWUG started initially in 2001	Initiator
		It started from a community network with people living in the same street	First test
		They connected to each other via Wi-Fi to see how far they could push it.	Wi-Fi connection
		In 2006 there was an interconnection that connected the splintered Wi-Fi networks into one bigger network	Interconnected network
Background of the initiators?	Kieran Murphy and Co were university students studying computer science. They wanted a platform to connect data on. At that time internet penetration in South Africa was very low and very costly. They	Kieran Murphy and Co were university students studying computer science	Technical Knowledge
		They wanted a platform to connect data on.	Had need of network
		At that time internet penetration in South Africa was very low and very costly.	Lack of, or low connectivity

	wanted a platform to connect until they could collaborate their projects remotely.	They wanted a platform to connect until they could collaborate their projects remotely.	Had use of network
Was the driver of the network just for educational purposes?	The major driver was that they were gamers. They were looking for a gaming platform. This provided a low cost gaming platform for them. They further developed it into a learning and experimental network.	The major driver was that they were gamers.	They know the potential of the network
		They were looking for a gaming platform.	Had need of the network
		This provided a low cost gaming platform for them.	Needed a cheap network solution
		They further developed it into a learning and experimental network.	Learnt how to develop the network
How was the transition from the splintered groups to JAWUG?	It was informal. There was no committee or management body running it. Once in a while they held technical/admin meetings once or twice a month to decide what needs to happen. The network grew to a high user base and that was the point they realized that they needed a single management body to take the initiative further, hence the JAWUG management committee was formed. The management body consists of 6 elected officials.	It was informal	People of like minds
		The network grew to a high user base	People of like minds
		..that was the point they realized that they needed a single management body to take the initiative further, hence the JAWUG management committee was formed.	Formation of management
Why Wi-Fi?	In South Africa back then, if you had to do something private, the only alternative was Wi-Fi. The spectrum was free, hence the 2.4 to 5.8GH spectrum was free to exploit.	In South Africa back then, if you had to do something private, the only alternative was Wi-Fi	Unaffordable existing technology
		The spectrum was free, hence the 2.4 to 5.8GH spectrum was free to exploit.	Free Spectrum

How did people get to join the network as it grew?	In the early stage, the high cost and low speed of internet it did not fit in well with the gamer or geek culture. The data rates delivered on Wi-Fi were fast. There was a lot of excitement and the news spread by word of mouth.	In the early stage, the high cost and low speed of internet it did not fit in well with the gamer or geek culture.	Unaffordable existing technology
		The data rates delivered on Wi-Fi were fast.	Fast wireless data rates
		There was a lot of excitement and the news spread by word of mouth.	Growth by word of mouth
Who manages this network?	Volunteers work with the management board. The management board, of 6 persons, are elected during the AGM.	Volunteers work with the management board	Volunteer oriented
		The management board, of 6 persons, are elected during the AGM.	Management election
How do you solve technical problems with the network in areas?	There is a management body that handles the organization - administration. Working under them is the JAWUG core team, which is the administration team. The administration team is broken up by areas. They manage the land site, they manage, equipment and manage connectivity as well manage the users living in that area.	There is a management body that handles the organization - administration.	Management organizations
		Working under them is the JAWUG core team, which is the administration team	Management working group
		The administration team is broken up by areas.	Decentralized management
		They manage the land site, they manage, equipment and manage connectivity as well manage the users living in that area.	Management Operations
Are the committee members and volunteers rewarded in any form?	They work free of charge .	They work free of charge	No volunteer remuneration
How are new subscribers admitted into the network?	We have a club and we have membership fees, the membership fees are not dependent on whether you are connected to the	We have a club and we have membership fees, the membership fees are not dependent on whether you are connected to the network or not.	Membership sign up and fee

	network or not. The membership fee is, a levy for the general network overload. If new members join they can connect the network in their area, once the membership fee is paid. However, there is no requirement to pay as such.	If new members join they can connect the network in their area	Membership control
Is there any subscription for maintenance once connected to the network?	No just the yearly membership fee	No just the yearly membership fee	Annual membership subscription
What is the number of subscribers currently using your network?	1500 - 2000 members are JAWUG subscribers. Others are in other wireless groups such as Pretoria, Cape Town, Durban and all the different areas. From time to time, depending on line of sight we interconnect to the other wireless networks. We are able to handle traffic from either side of the network and provide transfer through them.	1500 - 2000 members are JAWUG subscribers.	High adoption
		Others are in other wireless groups such as Pretoria, Cape Town, Durban and all the different areas.	Similar networks exist
		From time to time, depending on line of sight we interconnect to the other wireless networks.	The need to interconnect to other Wi-Fi networks
		We are able to handle traffic from either side of the network and provide transfer through them.	Traffic routing
Is this interconnection free?	Yes, it is free, because some Internet Service Providers have donated free bandwidth to us to enable us to connect some other network that are within line of sight.	Yes, it is free	No interconnection fee
		Some Internet Service Providers have donated free bandwidth to us to enable us to connect some other network that are within line of sight	ISPs provide free bandwidth
Was there any help from the government?	No. But however, there was an approach to the government and the regulatory agency. However, due to	No	No Public assistance
		But however, there was an approach to the government and the regulatory agency.	Attempt to reach out to the government
		However, due to	Discouraged

	bureaucracy and delays they decided not to go through that route. Decisions can be taken quickly and initiatives made easier if these were to be done without the help of Government.	bureaucracy and delays they decided not to go through that route.	bureaucracy
		Decisions can be taken quickly and initiatives made easier if these were to be done without the help of Government.	Decided against government help
My impression is that Johannesburg is a cosmopolitan area and the level of education is high, but I do not say about income levels and this played a role in the adoption of the network is this right?	Yes, that is so. But there has been an attempt for the JAWUG and other wireless groups to get to the rural areas, but we faced the challenge of not getting much penetration. This is because the equipments are expensive; the level of education is low and to find people in the community that will be able to service the infrastructure is difficult. The people in rural areas have more basic needs than to be connected. This is why the rollout in rural areas has been very slow.	Yes, that is so	It is an urban network
		But there has been an attempt for the JAWUG and other wireless groups to get to the rural areas, but we faced the challenge of not getting much penetration.	Attempt at rural extension not successful
		This is because the equipments are expensive; the level of education is low and to find people in the community that will be able to service the infrastructure is difficult.	Cost, education level and technical know how lacking in rural areas
		The people in rural areas have more basic needs than to be connected.	Broadband not a priority in rural areas
		This is why the rollout in rural areas has been very slow.	Roll out in rural areas is slow
Would you say that it would be possible to have these community networks in rural areas even though it will be adopted over time?	It would be a good initiative. It is possible to roll out community networks in rural areas. It would help a lot of people and I think it would be adopted much quicker because if it is handled at the government level or in a broader level than just the community network, the adoption would be	It would be a good initiative.	Rural network is a good initiative
		..is possible to roll out community networks in rural areas.	Rural network is possible
		It would help a lot of people and I think it would be adopted much quicker because if it is handled at the government level or in a broader level than just the community network, the adoption would be quite	Support from public sector needed

	quite quick. The technology landscape in South Africa is changing and it is Broadband is still out of the reach of the average South African. The initiative will fix the gap perfectly.	quick.	
		The technology landscape in South Africa is changing and it is Broadband is still out of the reach of the average South African. The initiative will fix the gap perfectly	Community networks will work
Your network coverage extends to rural areas but you do not have users in rural areas	That is correct 100%	That is correct 100%	Network coverage in rural areas, but no users
Did you at any point think of partnering with big telecom companies?	South Africa at that time had a monopoly and they were not supportive. At the moment, we cannot traffic from one network transit to another telecom company's network. There is no much support, if anything; there is a push back from them on such initiatives	South Africa at that time had a monopoly and they were not supportive.	No support from telcos
		At the moment, we cannot traffic from one network transit to another telecom company's network.	No transit network with telcos
What steps are you taking to combat these challenges?	There is not much to do because government is in support of it. The telecom companies are backed by government regulations	There is not much to do because government is in support of it. The telecom companies are backed by government regulations	Government does not support interconnection
Would you say that the project has reached its maturity stage or it is still growing?	It is beginning to decline. Broadband price is falling and people are migrating to 3g, 4g etc. Our delivery speed is not as fast at the new networks. Slow throughput they opt for	It is beginning to decline	Project at peak
		Broadband price is falling and people are migrating to 3g, 4g etc	Competition from cheap mobile Broadband services
		Our delivery speed is not as fast at the new networks.	Mobile Broadband Provide better data rates

	fixed lines.		
Would this not be the point where community based networks could be developed in rural areas, just as the JAWUG initiative stood in the gap till the market grew, this would be the best time to push the services into rural areas?	I agree 100%, but in the rural areas we have a very unique problem of cable theft and the telecoms companies are rolling out WiMAX, which in a way is unaffordable, which points to the fact that Wi-Fi might still be the way to penetrate into these areas.	WiMAX, which in a way is unaffordable	Wimax unffordable
		which points to the fact that Wi-Fi might still be the way to penetrate into these areas.	Wi-Fi preffered
Are there other stakeholders that helped JAWUG along the ways?	ISP (direction on which way to go), the wireless Internet Service Providers Association (provided a regulatory framework for the free spectrum) Wireless application providers (protecting members by developing policies)	ISP (direction on which way to go), the wireless Internet Service Providers Association (provided a regulatory framework for the free spectrum) Wireless application providers (protecting members by developing policies)	Advice from technocrats
What are they you should have done differently?	The organization should have been formalized much earlier to gain enough momentum and support and financial backing. The momentum would have been far better. At the moment, the personnel are volunteers, and you can only volunteer the time that you have. For a time the top management was not consistent. People	The organization should have been formalized much earlier to gain enough momentum and support and financial backing.	Late organization of coop
		At the moment, the personnel are volunteers, and you can only volunteer the time that you have. For a time the top management was not consistent.	Inconsistent volunteers
		We would formalize the management earlier and set out a clear strategy for	Delayed initial strategy for development

	would volunteer and leave and voluntarily and come back. We would formalize the management earlier and set out a clear strategy for development. Aside the membership fee, where they other ways in which the project was financed? There was, a lot of our hardware vendors saw a market for providing the hardware, so what they did was sell the hardware to the member as the hardware we needed and then give the organization a rebate of a certain percentage of all the hardware sold. Other bodies donated money to the organization as they saw the gap to advertise their business and other members with private businesses offered a cash injection into the organization.	development	
		Aside the membership fee, where they other ways in which the project was financed?	Few stream of income
		There was, a lot of our hardware vendors saw a market for providing the hardware, so what they did was sell the hardware to the member as the hardware we needed and then give the organization a rebate of a certain percentage of all the hardware sold.	Incentive from hardware suppliers
		Other bodies donated money to the organization as they saw the gap to advertise their business and other members with private businesses offered a cash injection into the organization.	Donation from private sources
Did you receive any form of loans?	No	No	No loans
Would you say community based initiatives are expensive, if one were to look at the total costs?	It is. At the moment high speed links are being deployed and these are expensive. There is also cost involved in upgrades when equipments are to be replaced.	It is	The process is expensive
Have there been	Not really. But we have	Not really	No serious

<table>
<tr><td rowspan="4">problems with accountability or problems with decision making?</td><td rowspan="4">had such situations where groups do not agree. The way out has always been that we (the management) will handle the network in a way that we see fit. And then we will deal with the issue you raised, if we see fit. Afterwards, when the group finds out that their alternative idea is no sustainable they end up coming back. This because it is easier to work in numbers harnessing economics of scale, hence we can exploit that.</td><td></td><td>accountability or decision making problem</td></tr>
<tr><td>We have had such situations where groups do not agree</td><td>Disagreements do occur</td></tr>
<tr><td>The way out has always been that we (the management) will handle the network in a way that we see fit. And then we will deal with the issue you raised, if we see fit.</td><td>Management dispute resolution</td></tr>
<tr><td>Afterwards, when the group finds out that their alternative idea is no sustainable they end up coming back.</td><td>They come back as part of JAWUG itself. They work together</td></tr>
<tr><td>When the organizations return to join JAWUG, are they integrated into JAWUG or as partners?</td><td>They come back as part of JAWUG itself.</td><td>They come back as part of JAWUG itself.</td><td>Problem resolution</td></tr>
</table>

Appendix E.2.2 Open Coding for Pre-commercialization phase of Air Jaldi (Dharamsala)

Paragraphs, Words, Phrases and sentences from interview responses	**Memo**	**Code**
At a time there were many	This denotes the demand pull for	NGOs have need of ICT

local organizations in Dharamsla that already had computers. They were desperate for Internet Access.	Internet connectivity by the NGOs	connectivity to enable information sharing
I sold my shares in the company, I co-founded in the USA and returned to Dharamsala, my work focus was Internet connectivity to all communities	The NGOs identify and recruit technical expertise	Yahel goes to live in India
We have learnt to use Wi-Fi to make very long wireless distance links	Yahel decides on which Broadband solution to adopt	Yahel opts for wireless connectivity
I got a call from a friend who was working with the Tibetan Government in Dharamsala, a little small town in the Indian Himalayas.	The NGOs identify and recruit technical expertise. This could also imply recruiting help, hence an NGO resource	A friend contact Yahel in the US
Many of these NGOs worked in collaboration and they were willing to share the costly links of the satellite (VSAT)	A vital resource	NGO Vsat
I sold my shares in the company, I co-founded in the USA and returned to Dharamsala	Yahel's passion for wireless networks leads him to commit his personal resources to see the success of the project	Yahel commits his personal resources to develop connectivity
I spent the 80s and 90s, designing and building internet service providers and data centres across the globe.	Yahel already has experience in setting up wireless networks, hence he has technical knowledge	Yahel adopts his previous knowledge of setting up networks to facilitate connectivity
These are areas without Internet connectivity. My	Yahel's voluntary work is filled by personal interest and passion for	Yahel has passion for rural

passion has been to aid in the facilitation of connectivity in these areas	connectivity	connectivity
I then start searching for solutions to connect the organization, I also searched for bandwidth from very far away cities	Once he got his equipments, he decides to try out his ideas by testing a few vantage points in the bid to building a network	Yahel tests different wireless networks
you can see my wife she is talking with an expensive IP phone to her sister in Israel and over a network that we build ourselves. This was a very good way to test the network, if she cannot make the phone call then we had to fix something	Here Yahel is confirming if his small network works and if the service will be useful to the users	Yahel tries international calls with his network
Within a few days of Wi-Fi deregulation, we had a small network of interconnected organizations all sharing a satellite link to the internet	The test is successful hence he decides to connect the institutions	Yahel begins connecting the NGOS
in 2005, India finally deregulated	This is a later public incentive, which was not aimed at Yahels network but the Indian Broadband ecosystem in general	In 2005 India deregulates Wi-fi spectrum

Appendix E.2.3 Open Coding for Commercialization Phase of Airjaldi

Interview Questions	**Responses**	**Paragraphs, Words, Phrases and sentences from interview responses**	**codes**

Can you give me a brief history of Airjaldi?	Airjaldi started as a social project, a personal mission by an Israeli (name Yahel Ben David), who had been living in Dharamsala for about 5 to 8 years. He had experience with building ISPs and had experience with radios. Gradually in India it was possible to use Wi-Fi for outdoor use for interconnecting buildings, but when they legalized it in January 2005, he had a small network built and ready to go ahead. He continued it for a while and grow it took it as a personal project for the betterment of children in orphanages there and school systems. Dhramsala is also the centre for the refugee Tibetans. This personal project continued till 2006 where I (Jim) and some others joined Yahel to organize a workshop. This workshop was an outgrowth of work that was first done in Europe between Berlin and London. They held workshop and international conferences one in Berlin, one in London and one in Djursland in Denmark about wireless networks and they invited people from various parts of the world, so they chose Dharamsala as the next conference venue so they could learn more about Yahel's network. So I got involved to help plan the conference and that was my first trip to India	Airjaldi started as a social project	Social project
		an Israeli (name Yahel Ben David),	initiator
		He had experience with building ISPs and had experience with radios	Persona knowledge wth radios
		Gradually in India it was possible to use Wi-Fi for outdoor use for interconnecting buildings, but when they legalized it in January 2005,	Legalization of free Wi-Fi
		he had a small network built and ready to go ahead. He continued it for a while and grow it took it as a personal project for the betterment of children in orphanages there and school systems.	Experimentation
		Dhramsala is also the centre for the refugee Tibetans	Identified potential users
		This personal project continued till 2006 where I (Jim) and some others joined Yahel to organize a workshop	Positive experiment , gathering of like minds
		This workshop was an outgrowth of work that was first done in Europe between Berlin and	Publicity at conference

	and spent about 3 weeks looking at India and trying to understand how they came about with the low cost structure that would provide good Internet to the people. So we brought in another person, Michael Ginguld who had been in Dharamsala previously and was a friend of Yahel. So he came, we programmed, made our plans for 2009, organized how to make the network a commercial entity and to register it as a private company in India called rural Broadband. So, since 2009, we have been proceeding on that commercial thing, but Yahel went to grad school in Berkely UC Berkerly in computer science back in 2008. Michael leads the management team in Delhi, so we have been gradually growing it since then.	London.	
		So I got involved to help plan the conference and that was my first trip to India and spent about 3 weeks looking at India and trying to understand how they came about with the low cost structure that would provide good Internet to the people	Financial actor induced by positive experiment
		So we brought in another person, Michael Ginguld who had been in Dharamsala previously and was a friend of Yahel.	Recruitment of like minds
		So he came, we programmed, made our plans for 2009, organized how to make the network a commercial entity and to register it as a private company in India called rural Broadband	Organizational plan
The initial purpose for developing the wireless network was to develop rural wireless networks , has the purpose changed?	It is still the same. Rural areas are chosen because there is a big need for Broadband from a commercial point of view that translates into a good opportunity. Secondly, we were familiar with the technology for building networks using Wi-Fi with directional antennas. In rural areas that work fine, but in cities, there are issues with too much congestion, with	It is still the same	Purpose, rural wireless
		Rural areas are chosen because there is a big need for Broadband from a commercial point of view that translates into a good opportunity	Rural areas have great need for Broadband
		Secondly, we were familiar with the technology for building	Knowledge of how to facilitate

	interference and so forth. We focus on rural areas, but we also cover the intermediate areas, where there are schools, there are bus systems to the towns, there is limited internet from the outskirts of the town, so we are serving them as well, and people here will pay for it,	networks using Wi-Fi with directional antennas	the network
		In rural areas that work fine, but in cities, there are issues with too much congestion, with interference and so forth.	Potential of the network to rural areas
		In rural areas that work fine, but in cities, there are issues with too much congestion, with interference and so forth.	Technical feasibility f networks in rural areas
		We focus on rural areas, but we also cover the intermediate areas, where there are schools, there are bus systems to the towns	They have networks in semi-urban areas too
		there is limited internet from the outskirts of the town, so we are serving them as well, and people here will pay for it,	Ability to pay
		there is limited internet from the outskirts of the town, so we are serving them as well, and people here will pay for it,	There is demand
Can you give me a brief description of the Dharamsala rural area?	It is an area with low population density, there are village lots of villages from 500 to 1000 people and 1km away there is another 500 to 1000 people, there are farms with fields in between. In the plain areas they grow wheat, in the hilly areas they grow	It is an area with low population density	Low population density in rural areas
		there are village lots of villages from 500 to 1000 people and 1km away there is another 500 to 1000 people, there	Not so dispersed settlement

	smaller fields but they have animals. There are roads , not to every village, the road system is there and the electricity system is widespread but not running all the time, there is a bus service to the towns. In rural India varies in different states, there are states where there are poor states and there are states that are more prosperous. We are not in the poorest state. We are in the medium or prosperous state. They may be rural but net the poorest of the poor.	are farms with fields in between	
		In the plain areas they grow wheat, in the hilly areas they grow smaller fields but they have animals. There are roads , not to every village,	Rural users are farmers
		the road system is there and the electricity system is widespread but not running all the time, there is a bus service to the towns	Some form of social amenities
		rural India varies in different states	Rural areas vary
		They may be rural but net the poorest of the poor.	Not the poorest of the poor
Are you receiving any help from the Government of India?	No	No	No public funding
How is AirJaldi funded?	I provided some additional capital and I was added to the management team. We are a commercial entity and we have to provide services that people want and are willing to pay for. We have many schools as customers. Both Private and public school pays for books, so the proposition to the school is that they pay 1 dollar per term for their student to access the internet on the computer	I provided some additional capital and I was added to the management team	Private capital injection
		We are a commercial entity and we have to provide services that people want and are willing to pay for	Commercial entity
		We have many schools as customers	School as anchor tenant

How was your need assessment done to understand what people will pay for, did you conduct a research?	No. We just went in there. This is because it is a commercial entity	No. We just went in there. This is because it is a commercial entity	No needs assessment
Were there other stakeholders that helped you in starting up?	Yes, the private school system which consisted of 13000 schools across India, they had ICT teachers, so that was helpful. Also, people from the Western part of the world came to help.	Yes, the private school system which consisted of 13000 schools across India, they had ICT teachers, so that was helpful.	Help from schools and ICT school teachers
		Also, people from the Western part of the world came to help	Help from westerners
What do you think is motivating the People of Dharamsala to subscribe to your service?	It is the same reason people in California subscribe or in Europe subscribe to the internet, that is connecting with friends and family, looking upon information that might help them with their studies or with school and there is entertainment. Entertainment is always a big thing, so people they pay for these services, they watch movies and they watch movies with their friends. We also have a Facebook page which acts as a bridge to all apart from that it is communications to friends and family.	that is connecting with friends and family	User need network effect
		looking upon information	User need for information
		their studies or with school	Users need study aid
		is entertainment	Users need entertainment
Can you tell me about the other sister networks in India are they still	Yes, we have 5 networks in 4 states in India. We use the networks to expand, we have used our business strategy of the anchor tenant or anchor	Yes, we have 5 networks in 4 states in India	Network growth,5 networks
		In one place there is a	Anchor tenants,

in operation?	customer. In one place there is a bank doing rural banking, they needed access and the mountain section of India was very limited in access so we took a contract to deliver internet to the very mountainous area, it was difficult, but we did it, but we knew that there was a small town close by that was a tourist place in India which is popular in India, so we thought we would see some good private schools as well as see some business of our own which we have been. Another anchor customer was an individual engaged in BPO, business process outsourcing, but he wanted a rural BPO and he said if he had internet access there, then he would buy it and he now has 450 seats for people working there. There are other BPOs in India, but they handle the role setting, but the advantage to is that, it is a better working environment for the people and there is less and there is a stable workforce in a cleaner environment. The place is really a small town. The rural banking company came back to us 2 years later and the network was successful, so they expanded it to 50 sites and we are now in the process of doing one of them in south India.	bank doing rural banking,	rural bank
		small town close by that was a tourist place	Anchor tenant,tourist town
		individual engaged in BPO, business process outsourcing, but he wanted a rural BPO	Anchor tenant , rural BPO

Have you had an experience of developing a network in any part of India that was not successful?	No	No	Network decline so far
What were the factors that you considered before going into an area to develop a network?	We assess the economic activities of the area. We use Google earth to check pictures of the area, and having been in other places in India, we have some idea of what is there. Then we send a team to do an on-site survey of the villages to find out if there is an economic base. Are people driving some cars, some taxis, bicycles, motorbikes? If there are no motorbikes then people do not make some money.	We assess the economic activities of the area.	User need assessment via economic actives
		We use Google earth to check pictures of the area	User need assessment via Google Earth
		on-site survey of the villages to find out if there is an economic base	User need assessment via site survery
		no motorbikes	Threshold economic activity via existence of commercial motorcycles
Do you consider the population of the village as well?	Yes, the fact that the villages are crowded are not far apart as mentioned earlier, about maximum 500 km apart but there is plenty of demand and it is our mission to supply that demand .	Yes, the fact that the villages are crowded are not far apart	Crowded Village makes it easier to deploy- demand
Do you have the same factors for providing your services in the cities as well as rural areas?	It is more difficult and expensive in rural areas, but in return there is less competition for our services. It is needed more. In the rural areas, we make all our equipments to be solar powered so we are not dependent on the electric grid	is less competition for our services	Less competition in rural areas – incentive to deploy
		It is needed more	Rural Areas need the service more

	which is quite unreliable.	we make all our equipments to be solar powered	Renewable energy used rural areas – innovative cost reduction
And the wireless technology is Wi-Fi?	That is correct	That is correct	Technology of choice Wi-Fi
I believe you adopt it because of the topography the mountains?	Yes. It is very inexpensive and very available	It is very inexpensive and very available	Wi-Fi equipment is affordable
The Dharamsala wireless I hear it is the largest Wi-Fi network in the world?	It is probably not ,but quite a good size	probably not ,but quite a good size	Dharamsala network, one of the largest in the world
Why was this network necessary?	It is the demand, people want to talk, people want to send email. Michael had a personal connection with the area so it was happenstance. Aside that western tourist also wants the internet. It was an economic disadvantaged for a service in that area.	people want to talk	People want to talk
		people want to send email.	People want to send email
		western tourist also wants the internet	Trourist in Dharamsala need Internet
		economic disadvantaged for a service in that area	Dharamsala was economically disadvantaged
Why not Wimax?	The equipment was more expensive, it acquired, access to license spectrum. It would result in huge costs and small companies cannot use it. A company has to close to the mobile operator, we could not	The equipment was more expensive	WiMAX Equipment is expensive
		access to license spectrum	WiMAX Spectrum is not free

	use it.	A company has to close to the mobile operator, we could not use it.	WiMAX Operations is expensive
Did you go through some governmental processes in the setting up the network?	We are a registered private company in India, so we have to conform to all the laws and there is sales tax and service tax, which requires some book keeping. Before becoming a commercial ISP, you must have a license; we operate as a sub of a company that has a license because licenses are expensive. Recently they have lowered the price of the license so we will get our own license. We have had some investigations, but one of our managers in Delhi is a lawyer, so he is quite knowledgeable about the regulations. So he helped us through the process. Here in India you need an id to carry out a transaction with us as that is the government regulation. This ID is recorded and placed in our record.	we operate as a sub of a company that has a license because licenses are expensive.	Can operate under a sub license- government support
		Recently they have lowered the price of the license so we will get our own license.	Reduced license cost – public support
How was the relationship with the telecom companies when you started the business?	Largely we were invisible to them as we were so much smaller; however, we are now customers of theirs. We buy from them wholesale internet access, we distribute it through our infrastructure and resale it at retail. This is our business model. We are customers of the telcos.	We buy from them wholesale internet access, we distribute it through our infrastructure and resale it at retail	Bandwidth distribution – Business model
		We are customers of the telcos	Customer to telco - relationship with telcoms
If you were to invest in the poorest of the poor in India,	The government has these incentives like universal access funds, etc., but we are really	The government has these incentives like universal access funds	Possible public funds via Universal Service

what incentives would you expect from the government of India?	far too small to really use that.		funds
		but we are really far too small to really use that.	Not Big enough to get the funds
Do you think, Airjaldi would in the future develop a business model that would push internet supply into core rural areas?	Yes, but now we are providing fixed wireless internet services, i.e. internet access to buildings, such as schools, rural BPOs. As we grow and as we reach individuals, then we will expect some of them to have smart phones, in that sense, a prepaid model would work.	Yes, but now we are providing fixed wireless internet services	Plans to go into core rural areas
		Iinternet access to buildings	Supply Internet Access Buildings
		rural BPOs	Supply Internet Access to Businesses
Are there competing Broadband networks now and is it affecting your patronage?	No, I cannot say that now because the internet is only available in the cities, and that happens in several forms, including DSL technology over wires, including Wimax, including dense Wi-Fi in cities and 3G based mobile service. All these you do not find in rural areas, if it were so, we would not be in business. For the network operators in rural areas, the 3Gs drop and the 2Gs signal drop sometimes to nothing.	No, I cannot say that now because the internet is only available in the cities, and that happens in several forms, including DSL technology over wires, including Wimax, including dense Wi-Fi in cities and 3G based mobile service.	There is competition in the cities, but not in rural areas
So in Dhramsala, there is no competitor?	In the city, yes, but we provide services in the greater Dharamsala area. There is an area called.... valley. The area stretches for 60 km and 30 km across. We have a lot of areas here. We know that with time, the other services will come in, but we are sure that the schools and businesses would still want speed, more reliable service, a	Hence we will co-exist with the new competition.	Not afraid to co-exists with new competition

	school may want 2mbit, 4mbit to enable education, we can charge 50 dollars a month for 2mbits or 100 dollars a month for 4mbits, they can get that because they have several hundred students and teachers and so forth, it is very difficult for a mobile to supply, first because it eats a lot of bandwidth and second of all the businesses need more dedicated and secure services but the mobile operator would not provide that. Hence we will co-exist with the new competition.		
What payment model are you using?	Monthly Post paid	Monthly Post paid	Monthly post aid payment model
What is current subscriber strength?	No customer in urban areas, and more in rural areas, small towns. We have been doubling every year for the last 3 years.	No customer in urban areas, and more in rural areas, small towns. We have been doubling every year for the last 3 years.	More customers in rural and semi-urban areas

Appendix E. 2.4 Open Coding for the Ghana Wireless Project

Interviews	**Response**	**Paragraphs, Words, Phrases and sentences from interview**	**Codes**

		responses	
The impression I had from your website was that it was an ISP, but recently I realized that you were not an ISP?	No, not really, but we had the vision of being an ISP, unfortunately we had challenges as a result of sustainability	had the vision of being an ISP	Had vision of being an ISP
		had challenges as a result of sustainability	Had challenges with sustainability
Is the network still functional?	No, Teledata ICT came in as a competitor and as we were suffering from sustainability issues we could not compete. Clients were not paying their bills regularly?	Teledata ICT came in as a competitor	Initiative killed byTeledata ICT competition
		Clients were not paying their bills regularly?	Sustainability affected by clients not paying their bills
Can you tell me the history of your project, what was the idea behind the project?	John Atkinson initiated the project; he was a Peace Corps volunteer from the US sent to a centre in Apredie in the eastern part of Ghana to help the centre in the ICT section. The centre had an ICT section, a nursery and a library which provided support to the community. He came to support us and help the community, when he came and he thought it wise to use the redundant VSAT we had.	John Atkinson initiated the project	Initiator of project
		Peace Corps volunteer from the US sent to a centre	A Westerner led the initiative, peace corps
		eastern part of Ghana to help the centre in the ICT section	NGO – vehicle organization
		The centre had an ICT section, a nursery and a library which provided support to the community.	NGO was a community center
		use the redundant VSAT we had	Redundant VSAT
Who gave you the VSAT?	The schools around that was benefitting from it. So he led us to do a research from where the centre was	The schools around that was benefitting from it.	VSAT donated by benefitting schools

	towards the beginning of the town Akwapim north is an area that where we have the centre is the last town on the ridge. The research involved meeting offices, organizations and churches along the town to sell our idea of redistributing bandwidth to them so that they could share the cost of running the VSAT.	So he led us to do a research from where the centre was towards the beginning of the town Akwapim north is an area that where we have the centre is the last town on the ridge.	Market research led by tinitiator and team
The VSAT, was it the school that John was posted to?	Yes, it was a community centre to serve the whole ridge. But it was positioned in one town so that the neighbouring schools in the towns can use it. The schools did not have computer labs so the used the centre for their studies. They also used the centre as a library for the students to read. This was in 2006. We decided to share the bandwidth so that the cost we bear as a centre could be spread across so that we could sustain the library. We did research on the client to find out those who are interested and those that are not interested. We also tried to convince those who are not interested because at that time there was no internet at the ridge, the modems and masts were not here. We thought it wise that we could adopt the wireless solution	it was a community centre to serve the whole ridge	Community centre served Akuapim ridge
		it was positioned in one town so that the neighbouring schools in the towns can use it.	VSAT originally meant for the schools
		The schools did not have computer labs so the used the centre for their studies.	Community centre owned the computer lab
		centre as a library for the students to read	Community centre owned a library
		the bandwidth so that the cost we bear as a centre	Bandwidth redistribution – business model
		spread across so that we could sustain the library.	Initiative carried out to help sustain the library
		research on the client to find out those who are interested and those that are not interested.	Interested in interested clients

		We also tried to convince those who are not interested because at that time there was no internet at the ridge, the modems and masts were not here	Effort made to convince skeptics to join up
		We thought it wise that we could adopt the wireless solution	Wireless solution identified as cheaper
How did you convince them?	We told them that we had a internet that will benefit them if they subscribe to us it will help them in sending emails for easy transactions and cut down their cost of making telephone calls. We told them that globalization was setting in, so they had to adopt it. Most of them showed interest, however, they thought of the cost. Some were even of the opinion that the service should be free. We told them that is was impossible to give out the service free as the service infrastructure was also funded by another organization. Hence paying something would show a sense of gratitude for the organization's effort as well as the fact that the project can be sustained. They were all interested. Wireless Ghana was the first rural wireless project that was established in Ghana before TeledataICT came into the picture here.	sending emails for easy transactions and cut down their cost of making telephone calls.	Convenient email transactions – convince less interested users
		that globalization was setting in, so they had to adopt it.	Globalization – convince less interested
		they thought of the cost	Potential users thought of cost
		Some were even of the opinion that the service should be free	Potential users wanted free services
		first rural wireless project	First rural wireless initiative in Ghana

How did John identify those he wanted to work with?	We were already IT workers in the centre, so we were his first port of call. We thought it wise that it was a nice idea. As a peace corps volunteer if they initiate a project, it gives credit to them and to the organization and the organization sometimes help .	We were already IT workers in the centre	Workers from IT section of centre were Johns first converts
		We thought it wise that it was a nice idea.	IT department liked the idea
		As a peace corps volunteer if they initiate a project, it gives credit to them	John motivated by credit as a peace corps volunteer
At the last ridge of Akuapim, what is the socioeconomic situation?	They are not that educated, they are farmers, there are few graduates, but live in the city and in other parts of the region. The farmer makes about 100 Ghana Cedis a day in a good day. They cultivate maize and sometimes palm nut. There is electricity and water supply to the homes and bore holes as well to those who don't have access to water. It is not the poorest of the poor village. There are churches, organizations, including water aid and other NGOs. Water aid was our customer as our service helped them. There are micro finance and rural banks and Ghana Commercial Bank (GCB). GCB uses VSAT. We could not convince the rural bank because after the test we did with them, our bandwidth could not sustain their operations. There are hotels. Restaurants district assembly offices, small businesses.	They are not that educated	Low level of education
		they are farmers	Residents are mostly farmers
		few graduates, but live in the city and in other parts of the region.	Educated ones live in near by towns
		The farmer makes about 100 Ghana Cedis a day in a good day	Low level of income
		There is electricity and water supply to the homes and bore holes as well to those who don't have access to water.	Low basic amenities
		is not the poorest of the poor village	Not the poorest of the poor
		There are churches	Churches
		organizations,	Organizations
		other NGOs	International

	etc.,		organizations
		micro finance	Micro finance bank
		rural banks	Rural banks
		hotels	Small hotels
		Restaurants	Local restaurants
		district assembly offices	District office
		small businesses	Small businesses
Who provided bandwidth?	NCS, now they have a new name. After NCS we could not pay the bill so we went for TeledataICT. They saw the market potential and decided to invest. Their service was expensive; they could not sustain it after one year. The district assembly, where potential subscribers, but due to bureaucracy and they could not pull through, same with the district education. The hotels did not have many customers; hence they were not in need for much bandwidth Hence teledata could not handle it.	NCS,	NCS ISP bandwidth provider
		we went for TeledataICT	Teledata ICT, later ISP when NCS folded up
		They saw the market potential and decided to invest.	Teledata ICT – latter competitor
		Their service was expensive; they could not sustain it after one year.	Teledata ICT was expensive, hence could not sustain operations
		The district assembly, where potential subscribers, but due to bureaucracy	no help from district assembly
		The district assembly, where potential subscribers, but due to bureaucracy and they could not pull through, same with the district	No help from district education

		education	
		The hotels did not have many customers	Hotels had few customers, hence low demand
So after you convinced the people how then did you roll out the network?	The network roll out involved us meeting the people from door to door, if they accept the service we give them a pro formal including the hardware the client had to buy and the accessories needed for access. When the client pays then we do the installation. What we did was to use a an old personal Computer (PC) with no hard disk, but with a workable Compact disc (CD) rum, in this case one could just boot the PC with the CD rom, this makes booting faster. The CD itself was the client billing system given to the client. The ram size had to be higher. We had the software from the USA who customized the software. The company's name was community wireless. Initially the software was not stable, new versions were being released every week. The problem with the unstable software was that anytime there was power fluctuation of the electricity went off, then it had to reboot again leading to loss of data the user was working with. Usually we had to take care or some means of transportation to the client to	The network roll out involved us meeting the people from door to door,	Door to door meeting asking for connections
		if they accept the service we give them a pro formal including the hardware the client had to buy and the accessories needed for access.	Interested clients got proformal invoice indicating CPEs needed for connectivity
		The CD itself was the client billing system given to the client.	Billing system installed at the clients end
		The problem with the unstable software was that anytime there was power fluctuation of the electricity went off, then it had to reboot again leading to loss of data the user was working with. Usually we had to take care or some means of transportation to the client to hello reboot. The billing, of course, was not affected.	Billing software was initially affected by inconsistent power supply
		we gave them the system unit free.	CPU given to customers free
		The first test that we	First test on a

	hello reboot. The billing, of course, was not affected. Finally, they got the stable software, once the light goes off and returns the software reboots automatically and the users work is saved. The devices the client has to buy was ups, directional antenna, this depended to the spot. We then point your antenna to our access point. we gave them the system unit free. The first test that we ran was at a church which was on a hill. From the church there was a line of sight to our centre, the church had a high tower beside it. so we opted for using the directional antennas to connect the two spots and then used an omnidirectional antenna at the church to serve the neighbours who were interested clients living by the church. So we had two access points. We provided the omnidirectional antenna and the directional antenna to our end.	ran was at a church which was on a hill.	church
Who paid for the free accessories?	It was the centre that was supporting, the centre got funding from Cblit, and they have an office in the United States and in Ghana. The one who brought the centre was working with the World Bank, so she brought the centre to support the community. It was cblit that set up our centre. Our centres name is Apredie	It was the centre that was supporting, the centre got funding from Cblit,	NGO provided the free CPUs
		Our centres name is Apredie resource centre.	CBLIT set up the Apredie resource center

	resource centre.		
How much were they paying to access the service?	They paid 150 Ghana cedis monthly on the average if they lived close to the centre. Those who lived far away paid much more because the equipment needed to transmit the signal farther away was expensive. Hence the monthly cost of transmission was also high. On the average, they paid 310 Ghana Cedis (mostly for organizations). For organizations and people with more computers hooked to the network, they paid 50 Ghana Cedis per node. In such cases, a rebate of one node free was offered. For access, there was no fee; all they had to do was to buy the devices stated on the invoice. But in general, we charged them based on the bandwidth there was no standard pricing, data rate fluctuated between 128 and 512kbps. It was useful for those running internet cafes. However, we were running a deficit as the income was less than the expenditure, hence it was difficult to go for a higher bandwidth and the bandwidth requirements was rising by the day.	They paid 150 Ghana cedis monthly	High monthly subscription fee
		they lived close to the centre	Lower subscription if subscriber lives close to community center
		Those who lived far away paid much more	Higher subscription if subscriber lived farther from the community centre
		equipment needed to transmit the signal farther away was expensive	Cost disparity based on equipment needed and distance
		paid 50 Ghana Cedis per node (mostly for organizations).	Organizations paid per node
		a rebate of one node free was offered	One node offered free
		For access, there was no fee	No access fee
		the devices stated on the invoice	Customers only bought CPEs, but CPUs was given free
		data rate fluctuated between 128 and 512kbps.	Bandwidth of 128kbps to 512kbps
		However, we were running a deficit as the income was less than	Income less than expenditure

		the expenditure,	
		higher bandwidth and the bandwidth requirements was rising by the day.	User consumption of higher bandwidth led to reduction in cost
Would one be right in saying that some people were not happy about the fact that there was inequality in subscription fees?	No, not exactly. We alone knew the bill sent to each person. We explained to them that the farther they were, the more costly the transmission equipment. The subscription grew as a result of most using the service for downloading and streaming Youtube.	The subscription grew as a result of most using the service	Streaming and downloading led to bills users could not pay
		downloading	Users were downloading
		streaming Youtube.	Users streamed YouTube
How much bandwidth did you buy from NCS and later teledata?	1mb	1 MB	Low bandwidth 1mb redistributed
How much did that cost?	407 Dollar a month	407 Dollar a month	High wholesale cost of bandwidth 407 dollars a month
How did the people in these areas get to know about Youtube etc?	The centre we had was a hub for ICT for the Akuapim ridge people. People came in to check their mails after work in the evenings. It was like a telecentre. It was used for ICT trainings and a lot of other ICT related activities. It was the only centre with internet access. The community centre was a school, so it was in the evening after school that it was transformed into a community centre. Some were asking how the service	People came in to check their mails after work in the evenings. It was like a telecentre	NGO had a Telecenter a ICT hub and capacity building
		Some were asking how the service could be connected to their home	Potential of the usage of telecentre prompted demand

	could be connected to their home		
When John brought the idea, how was this idea received by the centre admin?	It was not easily accepted because the admin doubted the possibility of the network?	It was not easily accepted because the admin doubted the possibility of the network?	NGO were sceptical of john's ideas as result of the mountains
How did he convince the management of the centre?	He tried several devices, he bought the devices. He shipped in the test devices to run the test before we met the client. We had an uphill task to also convince the clients as well as they are is mountainous and there was no visible line of sight	He tried several devices	John did tests to convince NGO management
		he bought the devices.	He John bought the initial devices
		He shipped in the test devices to run the test before we met the client.	He John led the test runs fund by him
Did you have GSM at that time?	Yes, but the signal was poor	Yes, but the signal was poor	The Initial GSM signal was poor
Is it good now?	Yes, but not for all the networks, it is mostly 2 g and some spots have 3g	Yes, but not for all the networks, it is mostly 2 g and some spots have 3g	The GSM signals have improved a bit
Did you approach the private sector in the community to help fund the project?	No, because CBlit did not want us to do that. Secondly, they did not want to deviate from their area of core competence which was not the extension of wireless ICT.	No, because CBlit did not want us to do that. Secondly, they did not want to deviate from their area of core competence which was not the extension of wireless ICT.	Private sector participation discouraged by parent NGO
Where did the funding come from?	It came from the clients	It came from the clients	Major funding from clients, full commercial entity

You did not receive any external funding?	We received some money from the World Bank but it was for a case study on the project and not to fund the project If it was meant for funding the project ,maybe we would have expanded.	We received some money from the World Bank but it was for a case study on the project	Finance from the World bank was to fund case study research on the project
Which department handled the project?	It was handled by John and the IT department. Money that came from the clients was paid into the centres account at the Apredie community bank	John and the IT department	John led the management of the project supported by IT staff
		Money that came from the clients was paid into the centres account at the Apredie community bank	Client payment went to the centre
What was the purpose of the case study conducted by the World Bank?	They were interested in the project and wanted to support it, but they needed the case study to know how best we were running the project	They were interested in the project and wanted to support it, but they needed the case study to know how best we were running the project?	There was interest in the project from the world bank
What of the district assembly, ministry, etc., did they help in any way?	Cblit came in to run ICT training programmes for the area, the governments idea was to build a rural ICT hub for the country to extend telecentres. Hence UNDP was brought in to train the people. I have no idea about the funding; we trained the community schools and basic school leavers and gave them certificates. But the hub was not built. John went to USA to do a	Cblit came in to run ICT training programmes for the area	Parent NGO organizes ICTtraining - capacity building
		the governments idea was to build a rural ICT hub for the country to extend telecentres	Central government wanted to use the initiative as a hub
		Hence UNDP was brought in to train the	UNDP provided ICT training at

	presentation on wireless Ghana	people	NGO
We have village structures in Africa, what was the role of the village in this project, is it not possible for the village to run such a network it was, we tried that as the system was about to collapse?	The village decided to help because we consulted with the chief. The chief wanted to take the centre as a community project and look for funding to sustain it. But the CBlit the mother company decided against it. The same case happened in koforidua but the mother company did not want to be involved on a larger scale. This led to an end of the wireless Ghana project	The village decided to help because we consulted with the chief. The chief wanted to take the centre as a community project and look for funding to sustain it. But the CBlit the mother company decided against it. The same case happened in koforidua but the mother company did not want to be involved on a larger scale. This led to an end of the wireless Ghana project	Village willing to use its resources to sustain the project
What is the motivation of the NGO to go into ICT and rural development, what is their core competence?	The idea they had was to build community centres and to have libraries and educate the school children in reading habits to bridge the digital divide between the children in the city and children in the village. So the wireless Ghana project was out of context to the scope of their operations	bridge the digital divide	The only interest of the NGO was to bridge digital divide
		So the wireless Ghana project was out of context to the scope of their operations	Wireless Ghana was out of scope for the NGO

Appendix E.3: Open Coding for Public Initiative (Developed Country Case)

The Case of the Almhult Municipality Broadband Initiative is coded separately in the bid to identify the role of the public sector in this initiative. This understanding would aid in gaining inspiration on what to propose as the role of the public sector in the proposed PPI model. Secondly, the municipality initiative extended to 9 parishes, and some parishes existed before the initiative was conceived.

Appendix E 3.1: Open Coding for Almhult Municipality Broadband Initiative

Interview	**Response**	**Paragraphs, Words, Phrases and sentences from interview responses**	**Open codes**
Who is delivering what, who is in charge of the service?	We have a very large landscape and a very small city called Almhut, The commercial Companies, Telia and Telenor etc., do not have enough money digging out in the landscape even the reception of mobile phones is so bad in some of the areas. People complain. In the good old days you had to do only voice, so you had to go out there and nowadays still you still have to go outside. To give you a background about the circumstances, here we have Almhut, the city so to speak, then we have the larger villages like Hallaryd, Delary,Göteryd,Pjätteryd Häradsbäck, Stenbrohult....... in those places we have municipality workers, everybody knows them. In 2010 the politicians made a decision to connect Almhult with the parishes or Villages	The commercial Companies, Telia and Telenor etc., do not have enough money digging out in the landscape even the reception of mobile phones is so bad in some of the areas	Area commercially unviable to commercial entity
		People complain	Poor mobile reception in most areas
		People complain	Poor user satisfaction to current mobile service
		here we have Almhut, the city so to speak, then we have the larger villages like Hallaryd, Delary,Göteryd,Pjätteryd Häradsbäck, Stenbrohult	A small city surrounded by villages
		.... in those places we have municipality workers,	Municipality workers are stationed in villages
		In 2010 the politicians made a decision to	Political decision to connect

	using Fibre optics where we have municipality work. Basically, you have to put it all together in an internal network to enable them get access to all the servers and work with the services that are here in the house (4:05) but in the same decision they also wrote about the possibility for the areas to connect to the fibrenet if they make projects themselves out there. **(4:16) Payeffort and samova** who own cable in these places have fibre in these places, but not in all are not so keen on handing that out to the community. They wanted a lot of money for that. Telia owns the fibre out there. So the community decided to build fibre-net..	connect Almhult with the parishes or Villages using Fibre optics where we have municipality work	municipal workers to Almhut with fibre
The Intention in the beginning was to connect municipality offices?	Yes	Yes	Purpose, connect municipality stations
Then you said, we come to the municipality offices, so let us give it to the people?	Yes, now we have the basic infrastructure in place so it is now easy for the private homes to connect. But the communities themselves did not want to lead the project like in Hallaryd, Harradsback, Pjätteryd. The people living in the other parishes have decided to take up the project. We have agreed on the terms on which they can connect to the fibrenet.	Yes, now we have the basic infrastructure in place	Municipality fibre proximity to people
		it is now easy for the private homes to connect.	Possibility for people to connect
		. But the communities themselves did not want to lead the project like in Hallaryd, Harradsback, Pjätteryd.	Bigger communities expect government lead of supply
		The people living in the other parishes have decided to take up the project	Smaller communities take initiative
		We have agreed on the terms on which they can	Operating terms by municipality

		connect to the fibrenet	
Who owns the fibernet back bone?	It is owned by the municipality, but the access point connectivity to the villages is owned by the people (communities). In Almhult the communities form cooperatives. We deliver fiber and set up a technic house we are responsible for getting the equipment needed, so they need to get the active fibre cable into the technic house.	It is owned by the municipality,	Fibre backbone owned by the community
		access point connectivity to the villages is owned by the people (communities).	Access point connectivity owned by parishes
		In Almhult the communities form cooperatives	Parishes organize in form of coops
		We deliver fiber and set up a technic house we are responsible for getting the equipment needed	Municipality delivers fiber , equipment and technic houses
		so they need to get the active fibre cable into the technic house.	Community connect their fibre to technic houses
Do they pay for it?	Yes, the organization is like this. The Municipality buys all materials that are needed for the cooperative net like this fibre cable, in this we blow the fibre and connection poles where we put together a lot of fibres. We buy it and have a good price for that and the community orders from us ,like they need 30 km of this or something like that and we deliver it to them and they are in charge of putting it into the ground.	The Municipality buys all materials that are needed for the cooperative net like this fibre cable,	Municipality purchase coop needs for coop
		they are in charge of putting it into the ground.	Coop pays
Do all the communities have their own coops?	Yes, now, we have divided the whole municipalities into 9 areas. I was involved and we made the borders, so that no one is left behind So these are not geographical borders? We are using the old borders on how we are divided into the church, so we have tried to	Yes,	Demarcated parishes own coops
		We are using the old borders on how we are divided into the church, so we have tried to follow the old formal organization because	Coop demarcation based n old church organization

<table>
<tr><td rowspan="2"></td><td rowspan="2">follow the old formal organization because people feel that they belong in this way. And in these 9 areas, they have registered coops and have registered under state legislations.</td><td>people feel that they belong in this way</td><td></td></tr>
<tr><td>And in these 9 areas, they have registered coops and have registered under state legislations</td><td>9 coops registered</td></tr>
<tr><td rowspan="5">Did the municipalities do anything to encourage the formation of these coops?</td><td rowspan="5">This area, number 5 here started their coops 5 years ago, before the municipal politicians took the decision. When they started this project they had no way to connect, but they almost all infrastructures in those areas were damaged in 2005 in the storm, they had no phone, no mobile phone. After the storm, Telia announced that they would not rebuild the phone net again as it cost too much money, and the technic is old, that was 10 years ago and even older now there was a lot of damage and there were few people living in this area, so they do not have many customers. They promised to do what they can but know that within 10 and 15 years it will all be gone.</td><td>, number 5 here started their coops 5 years ago, before the municipal politicians took the decision.</td><td>Coop number 5 started their project 5 years before municipality decision</td></tr>
<tr><td>those areas were damaged in 2005 in the storm, they had no phone, no mobile phone.</td><td>Fixed and mobile infrastructure damaged by storm</td></tr>
<tr><td>After the storm, Telia announced that they would not rebuild the phone net again</td><td>Telia decided not to rebuild</td></tr>
<tr><td>as it cost too much money,</td><td>Damage too expensive for telia</td></tr>
<tr><td>the technic was old</td><td>Telia equipment too old</td></tr>
<tr><td rowspan="3">How many people live in Harradsbeck where this happened?</td><td rowspan="3">There are approx 4 or 500 homes where people live all year round and the rest are residents with summer houses by the Danes or Germans</td><td>there were few people living in this area</td><td>Low population</td></tr>
<tr><td>There are approx 4 or 500 homes where people live all year round and the rest are residents</td><td>Low population of permanent residents</td></tr>
<tr><td>summer houses by the Danes or Germans</td><td>Temporary residents own summer houses</td></tr>
<tr><td>By Law Telia is not forced to supply them?</td><td>Yes, it was taken to court and the court decided that Telia had no obligation</td><td>Yes, it was taken to court and the court decided that Telia had no obligation</td><td>Telia had no USO</td></tr>
</table>

They had no obligation to offer basic telephony?	What they did was to offer the so called permanent mobile function on the house, they had an antenna on the roof but it was based on the mobile net. For the first 3 or 4 years, it did not work at all. Many people got rid of the antenna and got rid of the phone and got an alternative that did not work Today they have fixed it.	What they did was to offer the so called permanent mobile function on the house, they had an antenna on the roof but it was based on the mobile net.	Telia offers temporary mobile solution
		For the first 3 or 4 years, it did not work at all.	Unsatisfactory service with mobile solution
		Today they have fixed it.	Telia eventually supply's mobile
The 400 or 500 is that the approximate number of people living in other demarcated areas?	Yes, approximately when all these areas are ready with their project, we estimate that 15 to 1600 homes connected to the net, that is about 50 not 60 percent of homes connected. We have a problem in the bigger villages, they feel like they are living in the city and the municipality should provide everything. In the small villages they do not expect the municipality to provide for them, they build the network themselves. The level of interest and cooperation to do it themselves is not so high in the bigger villages.	is about 50 not 60 percent of homes connected.	About Half households to be connected at first phase
		The level of interest and cooperation to do it themselves is not so high in the bigger villages.	Coop interest higher in smaller parishes than the bigger ones
What is the general level of response to the call to form coops?	So let's say about 50 %, but a little less in the bigger villages, but 70 to 80 percent of the landscape.	So let's say about 50 %, but a little less in the bigger villages	About 50 percent response in bigger parish
		70 08 80 percent of the landscape.	70 to 80 percent response in smaller parishes
Did you have communities where you struggled to sell the initiative and the communities	Many of those communities, they had not started the process, when we gave them the opportunities. No 5 had already started. I live in, number 4 (Stenbrohult) we	In my village, the municipality built fibre in 2004, 2005, and 2006.	Knowledge of fibre development by some coop chairman
		so I and the chairman of	Chairmen of

that just accepted the initiatives?	also had many problems after the storm and originally I come from far up north. In my village, the municipality built fibre in 2004, 2005, and 2006. So I had the background. So as soon As I heard about the municipality initiative, we decided to go along with the municipality. So no 5 and 4 were on track first, then it took over a year, then the other areas joined in. I did not work with municipality at that time, but we had a coop and I was the chairman, so I and the chairman of number 5 were invited to speak at meetings at the other areas together with the person working for the municipality at that moment. The municipality used the meetings to engender interest in the other larger villages by using people from the smaller villages? The municipality invited 1 or 2 persons in each area to meet in this municipality office and presented the initiative and the possibilities it gave them.	number 5 were invited to speak at meetings at the other areas together with the person working for the municipality at that moment	active coops invited to speak at the big parishes -to ginger interest
		The municipality invited 1 or 2 persons in each area to meet in this municipality office and presented the initiative and the possibilities it gave them	Cross coop activities occurred at municipality office in almhult
. How did you find these people?	In Hallaryd for example, they already, for example, had some kind of organization in their meeting place. We had names and we invited those.	had some kind of organization in their meeting place.	Coops were formed along some existing organization – meeting of friends
		We had names and we invited those	Municipality located such organizations
Did the meeting create coerces for them on the technic or it was	It was just talking, in those early meetings, often it was only one person that was interested in the technic then	was just talking, in those early meetings, often it was only one person that was interested in the	Early adoption was slow

just talking together?	the projects depend on them? Yes, you need those nerds	technic then the projects depend on them	
They are not paid	Yes, they work voluntarily	Yes, they work voluntarily	Coops operate with volunteers
From the municipality point of view you are not dependent on this people?	No, from the municipality point of view, we are not depending on them, but in a long term perspective, if the whole municipality is to continue existing then there is the need a change of technic, as the municipality cannot be a company. So they you need the technical knowhow as well.	So they you need the technical knowhow as well	Municipality plan to train the volunteers on technology - sustainability
How did you identify the individuals, what was your selling point to the demarcated areas?	The selling point was primarily that somewhere between the storm in 2005 to 2017 or 18 almost all telephone cable net will be taken down, what will happen after that. We knew that at that time that it was not just the storm that led Telia to take the network down. They already had a plan that if the technic is so sold that they can't get spare part today, they have to get one down to get spare parts to get spare parts. That was the no 1 argument; you will not have any infrastructure besides the poor mobile service.	The selling point was primarily that somewhere between the storm	Storm catastrophy used to elicit interest
		2017 or 18 almost all telephone cable net will be taken down, what will happen after that	Obsolete technology idea used to elicit interest
		the technic is so sold that they can't get spare part today,	Lack of spare part for the then obsolete equipment
		you will not have any infrastructure besides the poor mobile service.	There will be no infrastructure besides the poor mobile service
Do these parishes have any form of government there?	No , not in that kind, they have this old organization to decide to have a party once a year and how to maintain the house that they meet for different people. We invited the chairmen of those groups, and we asked them to find suitable people for the project.	No , not in that kind, they have this old organization	There is no form of government in the parishes
		We invited the chairmen of those groups, and we asked them to find suitable people for the project.	Chairmen from organizations asked to elicit interest from friends and neighbours
Do you have an idea of what	It was basically because they had no infrastructure up to	It was basically because they had no infrastructure	Storm of 2005- motivation for

motivated no 5?	2005. Since the court decided that Telia had no obligation to supply, they realized that if they do not fix it they would have no infrastructure	up to 2005	formation of coop
		court decided that Telia had no obligation to supply	Court decided telia had no uso – motivation for coop
		, they realized that if they do not fix it they would have no infrastructure	Potential of no reliable infrastructure- motivation for coop
Could one say that other similar community initiatives in Sweden also played a role in they in 5 deciding to build the network by themselves?	Yes, we in 2010 when the municipality took the decision, we were late compared to other municipalities up north, Up north we have big landscape areas. We learnt from those initiatives	Yes, we in 2010 when the municipality took the decision, we were late compared to other municipalities up north, Up north we have big landscape areas. We learnt from those initiatives	Municipality influenced by the existence of municipality action up north- municipality motivation
Why fiber?	It is the best existing technics	It is the best existing technics.	Fibre is the best Broadband carrier= cost not an issue
What of wireless?	In 2000/ 2001, the municipality had a wireless network and today the municipality can't find spare parts for it and the capacity of wireless is less. The wifi technic, the area is too big and the signal is too dependent on the pole, we try very hard not to divide people into A,B,C, D where b has to receive less than A. In almhult, the Telia can make money by themselves, everybody will have 4G many will have fibre if they want to, but we all pay taxes, so we have the same	In 2000/ 2001, the municipality had a wireless network and today the municipality can't find spare parts for it and the capacity of wireless is less	Rare spare parts for wireless
		The wifi technic, the area is too big and the signal is too dependent on the pole, we try very hard not to divide people into A,B,C, D where b has to receive less than A.	Wifi does not provide the same data rates
What was the	It was a whole municipality	It was a whole	Municipality

<table>
<tr><td>organization when you were deploying wireless?</td><td>project all the way</td><td>municipality project all the way</td><td>facilitated project</td></tr>
<tr><td rowspan="3">Have you had complains from Telia indicating that you are competing with them?</td><td rowspan="3">Not so far. The regulation based on EU rules, is that where there are commercial possibilities we can’t compete with tax money, but if we can define or identify an area where commercial initiatives will not work we can't use tax money. Coops that are now digging such as 2, 5,4, 7, 1 all get subsidy from the EU.</td><td>Not so far.</td><td>No complaints from network operators</td></tr>
<tr><td>The regulation based on EU rules, is that where there are commercial possibilities we can’t compete with tax money</td><td>EU rules permit municipality facilitation of telecom infrastructure</td></tr>
<tr><td>Coops that are now digging such as 2, 5,4, 7, 1 all get subsidy from the EU.</td><td>Coops get subsidy from Eu</td></tr>
<tr><td rowspan="6">Are the communities also getting fibre connectivity from Telia as well?</td><td rowspan="6">Not today, today the municipality has made an agreement called a Swedish company Zitius, Zitius puts all the technic needed in the technic houses. The municipality does not own anything, they have the support there 24/7, they have a briefcase with service providers like Telia, Universal teecom, Bahnhof lda, viasat, risknet, alltele, Bredband2, T3 and we have an obligations to them that they provide 5 competiting service providers on internet, 5 on IP telephones and 2 on IP TV.</td><td>Not today</td><td>Telia not providing fibre connectivity in communities at the moment</td></tr>
<tr><td>today the municipality has made an agreement called a Swedish company Zitius</td><td>Zitius handles management and operation of municipality fibre= private sector involvement</td></tr>
<tr><td>, Zitius puts all the technic needed in the technic houses.</td><td>Zitius facilitates the technical equipments</td></tr>
<tr><td>The municipality does not own anything, they have the support there 24/7</td><td>Zitius provides customer support</td></tr>
<tr><td>they have a briefcase with service providers like Telia, Universal teecom, Bahnhof lda, viasat, risknet, alltele, Bredband2, T3</td><td>Zitius facilitates a consortium of Broadband service providers</td></tr>
<tr><td>and we have an obligations to them that they provide 5</td><td>Municipality decides the number of</td></tr>
</table>

<table>
<tr><td></td><td></td><td>competiting service providers on internet, 5 on IP telephones and 2 on IP TV.</td><td>service providers needed by zitius</td></tr>
<tr><td>So the public financing is only for the backbone network?</td><td>Yes</td><td>Yes</td><td>Fibre backbone is municipality financed</td></tr>
<tr><td rowspan="2">Do the 5 ISPs, 5 IP telephones and 2 IPTV have access to use the fibre?</td><td rowspan="2">Yes, they reach Almhult in 1 box here, and tele2 is the highway to Almhult so Zitius buy capacity from tele2 to reach Amlhult and then to supply to our fibre net.</td><td>tele2 is the highway to Almhult</td><td>Tele 2 is gateway to Almhult</td></tr>
<tr><td>Zitius buy capacity from tele2 to reach Amlhult and then to supply to our fibre net.</td><td>Municipality fibre gains access from tele 2 infrastructure</td></tr>
<tr><td>Does this mean that the end user (community) will not have to pay much to access the service?</td><td>No</td><td>No</td><td>User subscription expected to be affordable</td></tr>
<tr><td rowspan="3">However, they pay one amount to have access to connectivity and service?</td><td rowspan="3">They pay one fee to be connected to the backbone, then we offered them that the municipalities will take care of all the services in their own fibrenet, so they pay a small amount for each customer per month. We have built a support organization so if one digs the fibre cable and tears it apart, then we have an organization, 24 7 that can repair it.</td><td>They pay one fee to be connected to the backbone</td><td>Coops pay monthly access fee to access municipality backbone</td></tr>
<tr><td>we offered them that the municipalities will take care of all the services in their own fibrenet</td><td>Municipality handles the maintains of the backbone via zitius</td></tr>
<tr><td>We have built a support organization so if one digs the fibre cable and tears it apart, then we have an organization, 24 7 that can repair it</td><td>Zitius provides 24/7 support service</td></tr>
<tr><td>But they pay for that basically?</td><td>Yes, they pay for that because if they did not pay up, then they will have to pay someone else. So now we can make a deal on the whole area and make a better price.</td><td>Yes, they pay for that because if they did not pay up, then they will have to pay someone else. So now we can make a deal on the whole area and make a better price.</td><td>Coops pays municipalities for Zitius services to the coops</td></tr>
</table>

So they pay for connectivity and they can go to the individual ISP to pay for the service, so they pay in two places in reality?	Yes, they pay for the maintenance of the fibrenet itself, and they also pay for the service from the service provider, they may need different data rates	Yes, they pay for the maintenance of the fibrenet itself	Monthly connectivity for maintenance of network
		they also pay for the service from the service provider, they may need different data rates	Coops pay enbulk to service providers
Do you decide on foot service packages they can pay for?	No, the service providers decide that themselves, so we put the basic layer, asking for the minimum no of the service provider.	No, the service providers decide that themselves	Broadband service providers decide on the service they provide
Which stakeholders were involved in this project?	We looked around. We made an active decision not to invite Telia, earlier in the process the person before me, invited Telia and Tele 2 and he explained the plan and how the municipality wanted it to be done. Initially Telia were no interested if is an open net that people has to compete with others. However, we are keen on being the provider and being the only one, after that Telia had reorganized and made a new division for open net, I think that they realized that they need to because open net is spreading even though Telia is trying to buy them all. So we were looking around so we sent out an invitation to 4 or 5 companies, there were a lot of questions and they also put a price on what they will pay as a feedback to the municipality. In the process, we picked Zitius.	Initially Telia were no interested if is an open net that people has to compete with others	Telia wanted a monopoly in service delivery
		. So we were looking around so we sent out an invitation to 4 or 5 companies, there were a lot of questions and they also put a price on what they will pay as a feedback to the municipality.	Open tender was made and Zitius was choosen
Is there a place we can see the list of current service providers?	Alhmult.qmarket.se. This is the service portal for Almhult	Alhmult.qmarket.se. This is the service portal for Almhult	There is a platform for users to pick the service provider-

			user choice
Do you have a time frame for this project?	The decision in 2010 in the municipality strategy so to say is that 2014 is the last year. At the end of this year the backbone should be in place. That was the number one decision and hopefully the coops on the road. Now last week there was a decision by the politicians to start a municipality owned company to take over and go into 2015 and so on. Now we have made a the politician fulfil their responsibility to get the backbone in the place now we are now going into the business part and they think the municipality owned company is the best way to go.	The decision in 2010 in the municipality strategy so to say is that 2014 is the last year. At the end of this year the backbone should be in place. That was the number one decision and hopefully the coops on the road. Now last week there was a decision by the politicians to start a municipality owned company to take over and go into 2015 and so on. Now we have made a the politician fulfil their responsibility to get the backbone in the place now we are now going into the business part and they think the municipality owned company is the best way to go.	Project has a clear timeframe for each case
The EU funding comes to you the municipality?	No, it comes to the county and all the coops have sent an application to the county and the county decided who will get the subsidy?	No, it comes to the county and all the coops have sent an application to the county and the county decided who will get the subsidy?	EU funding goes directly to the coops
But how important are these EU subsidies?	They pay about 50 percent, most of these coops that are now digging, the house owners pay between 20 000, 26 000, 27000 Swedish Crowns to the coop. For the fibre connection. The county decided that anyone getting subsidy must pay at least 20k Swedish crowns themselves, everything more than 20k can be paid by subsidies.	They pay about 50 percent,	EU funding covers close to 50percent of total cost
		20 000, 26 000, 27000 Swedish Crowns to the coop. For the fibre connection	Flat rate for user access
		county decided that anyone getting subsidy must pay at least 20k Swedish crowns themselves, everything	County disburses EU funds

		more than 20k can be paid by subsidies	
So the members of the coop 50 percent collectively	Yes, the municipality took the decision that it should be the same price for everyone within the coop. Coop funding may differ. But the issue is if you live in Hallaryd all must pay the same amount else the municipality will not collect.	Yes, the municipality took the decision that it should be the same price for everyone within the coop. Coop funding may differ. But the issue is if you live in Hallaryd all must pay the same amount else the municipality will not collect	Funding and access cost equality ensured
If EU funding goes from County to coop where does the municipality get money from for infrastructure?	When we connect them to the backbone, we send a bill to them, where they pay approx 8k for each connect house. The money consists of access to the technic house, service, material, fibre blowing, etc. We do not count on each coop on what they order we have a flat rate. The backbone is paid by tax money, a decision was made to invest 40 million Swedish krones on the backbone and in helping the coop to get started, but everything above 40mill should be paid by the customer in the network from a 30 year perspective, today we have a budget of 72 to 73 million all together. That is money spent without the coops having to pay back. The main point of doing this was to connect the municipality working station.	When we connect them to the backbone, we send a bill to them, where they pay approx 8k for each connect house.	Municipality sends monthly bill for access to its backbone to coops
		The money consists of access to the technic house, service, material, fibre blowing, etc.	Monthly fee pays for material fibre blowing and access to municipality fibre
		The backbone is paid by tax money, a decision was made to invest 40 million Swedish krones on the backbone and in helping the coop to get started, but everything above 40mill should be paid by the customer in the network from a 30 year perspective, today we have a budget of 72 to 73 million all together.	Municipality invests 40 mill skk in project
So the amount gathered from the members is those you recoup for investment in the backbone?	Yes and for the materials provided to them	That is money spent without the coops having to pay back	Monthly access fee helps municipality recoup cost
But when you say	Yes, we did so	. If someone phones me	User need

that you can define areas that are commercially unviable then you can build your network, how do you do that in Almhult town that is commercial?		and say can the municipality build a fibrenet here is there is enough interest in this area.	determined based on request based demand pull---- municipality determination of need
		Then we say if you get 50 percent, then we can do it, even if it might cost a bit more to reach this area	50 percent of population is needed for request to be adhered to ------ municipality determination of need
		We have made calculations on different areas to see what is the cost of building inside the Almhult	Municipality also makes
What is the average income of citizens in Almhult	If you have full time work you earn between 240k up to 500k a year before tax. We have a lot of people with high income due to IKEA. But many families do not have 2 persons working full time, only about 50 percent have 2 families working full time. 20 to 25k is a lot of money	If you have full time work you earn between 240k up to 500k a year before tax	Almhult residents are medium income earners (2000 dollars a month before tax
		We have a lot of people with high income due to IKEA	High income earners from ikea
		But many families do not have 2 persons working full time, only about 50 percent have 2 families working full time. 20 to 25k is a lot of money	50 percent with 2 families working fulltime
How much does in it cost in areas that Telia covers?	Telia takes 17k but they try to take the best part, if you a customer in their net, you can only use Telia as a service and they will get their money for the time subscribed for.	Telia takes 17k but they try to take the best part, if you a customer in their net, you can only use Telia as a service and they will get their money for the time subscribed for.	No threat from telia as there is no service competition on their infrastruture
Does the municipality have	Now we see that we will have an infrastructure in place, there	There is also within a healthcare project in	Demand aggregation

other plans towards rolling out infrastructure?	is an ongoing project in the house on future e services. Today you can find a formula for anything on the net and you can type on a writer at home, the next step is to fill it in the PC and press the button I spoke with the head of IT and he said all the formula will be online. There is also within a healthcare project in Sweden as a whole about healthcare in your home based very much on e-services, you can measure your blood pressure while connecting online at home. The initiative is driven by the country and the region. We have alarms for elderly people and most of them are connected via mobile phone and the techique is already in place to put to the fibre and if a person has not moved in 45 mins, it can start the camera, so someone in the hospital or elderly home can check to see if something is wrong. Of course, there is an integrity part, but it is absolutely possible. That is why it is important that everyone has connection got the infrastructure.	Sweden as a whole about healthcare in your home based very much on e-services, you can measure your blood pressure while connecting online at home. The initiative is driven by the country and the region.	facilitated by national and regional government
Can someone pay the 25k without using the service, do they have any running cost?	No, because you are not using the service, but they need to stay a member in the coop, and pay membership fee of maybe 100 or 200skk a year. This is because there are not so many elderly people who realize that it is important to have a connection, just like electricity, etc. but they don't have a PC,	No, because you are not using the service, but they need to stay a member in the coop	Connection without usage, you need to pay annual coop membership fee
		, and pay membership fee of maybe 100 or 200skk a year.	Coop annual membership fee-sustainability

	they do it for the next generation. It was decided that they don't pay for the service (1000skk a year) if they don't use it, in the big picture it is not so much money for the municipality. But it is important that they are connected		
What happens if someone comes in 5 years time and says, I also need a connection?	Out in the coop should have made the regulations themselves. They own themselves, so they make the decisions	Out in the coop should have made the regulations themselves. They own themselves, so they make the decisions	Coops make decision on future connectivity to users
Have you thought of escalation of cost over time or the lowering of cost over time, do you have price caps?	No, but we have a 3 year contract, if we see compared to other close by areas that Zitius is becoming too expensive for our customers we kick them out once the 3 years is over	No, but we have a 3 year contract, if we see compared to other close by areas that Zitius is becoming too expensive for our customers we kick them out once the 3 years is over	If current operator becomes expensive then a new operator will be employed
How long does the municipality intend to be involved in this business?	When I spoke to the politician's leader, she said the municipality will never sell the infrastructure. I agree with her. We have seen what happened to Telia for example, earlier, Telia was owned by the government and we had control over the infrastructure, now Telia is in the stock market, declaring every 3 months period, of course they see, where do we earn money and where do we loss money and they lost a lot of money from the old telephone network so they took it away.	she said the municipality will never sell the infrastructure	The infrastructure is expected to be owned by the municipality to protect public interest
		I agree with her. We have seen what happened to Telia for example, earlier, Telia was owned by the government and we had control over the infrastructure, now Telia is in the stock market, declaring every 3 months period, of course they see, where do we earn money and where do we loss money and they lost a lot of money from the old telephone network so they	Threat of ful corporatization-municipality against it-sustenance

		took it away	
Now till 2015 when you are looking at the business part of this model, will you still have a separate company managing the infrastructure and another agency managing the administration as it is done now?	From where I see it, I think we will still outsource infrastructure, we are not big enough to have 24 7 support for 2 to 3k customers and the technic ages quite quickly, so I do not think so. And from experience up north where the municipality manages the infrastructure they have problems getting the most well known service providers in their net as they have not been able to provide potential customers in their net. In our case the municipality will own the fibrenet and try to make the best business out of that both with Zitius and to another competitor, but it might become big business if we rent the infrastructure between 2 spots. As someone will sell their services to IKEA maybe, but they will need a connection to IKEA or any other company as they get the connection from Stockholm or Malmo or somewhere. To get to Ikea or Almhult they need to use the municipality'S fibre net.	. From where I see it, I think we will still outsource infrastructure	Infrastructure will be outsourced till the foreseeable future
		we are not big enough to have 24 7 support for 2 to 3k customers and the technic ages quite quickly, so I do not think so.	Municipality does not have the technical knowhow to manage infrastructure
		And from experience up north where the municipality manages the infrastructure they have problems getting the most well known service providers in their net as they have not been able to provide potential customers in their net.	Municipalities up north can't facilitate opennet –lesson from up north
		In our case the municipality will own the fibrenet and try to make the best business out of that both with Zitius and to another competitor,	Competition promoted by short contracts--sustainability
Have you had an experience where the coops run out of money or are in a financial difficulty?	Non has any problem yet, when they ran out of money, they stepped on the brakes and stopped digging. They apply for more money from the country and they were granted the money to continue digging. We have not had a major problem yet, but if it comes, we will have to do something about it. If someone runs out of money, we can loan them	They apply for more money from the country and they were granted the money to continue digging.	coops can apply for more money if they exhaust their funds
		If someone runs out of money, we can loan them money, then they can pay back over a number of years. We provide a lot of help to them	Municipality can loan coop money if they run out

	money, then they can pay back over a number of years. We provide a lot of help to them		
You have staff working with you on the municipality on this project?	We have a small organization, I work with 50 percent pay more or less, make it happen they say. I have another partner, who is more responsible with what happens in the field. He also works about 40 or 50 percent. One full-time	We have a small organization	Municipality operation handled by small staff
Who determines the right of way in the process of digging?	In the coop area, the coop has to reach an agreement with the landowners, if you dig along the bigger roads, we have the Swedish board of roads the coops apply and then they get n answer.	In the coop area, the coop has to reach an agreement with the landowners,	Coops and landowners determine right of way in their areas
		if you dig along the bigger roads, we have the Swedish board of roads the coops apply and then they get n answer.	Swedish broad of roads decide right of way along the bigger roads
Is there any Swedish law that permits municipality investment in public infrastructure?	Yes, there is some recommendation, I do not know if it is a law on how the municipality should work within telecom and fibre. The main thing is that in areas where the commercial interest is not working, you can use the tax money to build. After building, you need to run it. But the municipality should not play the part that Zitius is playing for us. It is allowed, but it is allowed, but we should look out every 3 years to see if there is a private company can play that role.	The main thing is that in areas where the commercial interest is not working, you can use the tax money to build	Swedish law permits municipality facilitating telecom facility with tax payers funds
		But the municipality should not play the part that Zitius is playing for us.	Swedish law does not permit municipality operating telecom facility
		It is allowed, but it is allowed, but we should look out every 3 years to see if there is a private company can play that role	Municipality relationship with private company reviewed every 3 years
What is your background?	I am a farm both from up north from.. I studied economics, and worked as an accountant	I studied economics, and worked as an accountant for 5 years.	No Prior experience with fibre deployment

	for 5 years. I moved here down south in 1997 with my wife. I have been running a milk farm for 6 year, after I worked as a senior advice within economic and business development within agriculture and forestry, today I run Forestry Company, which walk with kilning and the reason I am here was because I was involved in the coop 4 and the person who was here at the municipality decided to do something else within a short notice, they needed a solution quickly and someone who has in the process so I was invited. Now I am in it.		

Appendix F. Axial Coding Process

In this process, the identified codes are being categorized. The codes that are not relevant are dropped

Appendix F.1: Axial Coding Process for Developed countries

In this process, the open codes identified earlier are grouped for each developed country case. The relevant codes that identify the process of implementation are grouped. The codes that do not identify the process of implementation are dropped. For a code to be identified as leading towards implementation, it has to either be an intention leading to an action or interaction, an action or an event. However a will be seen in the categorization process, some of these relevant, intentions, actions and events being coded undergo an elimination process, if it does not lead towards implementation.

Appendix F.1.1 Axial Coding for DjurslandsNet Denmark

Open Codes	**Sub-category 1**
Understanding the innovator	
Bjarke became a fine arts teacher	Previous occupation
Bjarke embarked on personal capacity building	Previous educations
Bjarke is willing to learn new solutions	
Bjarke's Connection to teachers in djursland	Personal networks
Bjarke's ideal of democracy	Democratic thinking
Bjarke was an innovative thinker	Innovative thinking
Bjarke could think outside the box	Creative thinking
Bjarke's lesson with failure	Adaptation to failure
Bjarke's self-perception	Self-perception
Bjarke was a dreamer	Visualization
Bjarke could think outside the box	Broad thinking
Bjarke could sense potential in technology	Sense technology potentials
Bjarke could conceptualize solutions	Conceptualization
Bjarke's is willing to try his thoughts	Exploration
Bjarke is willing to overcome obstacles to see his thoughts through	determination
Bjarke is not deterred by high cost	
Bjarke learns from mistakes	Personal Adaptation to mistake
Bjarke calls for help	Willingness to seek help
Bjarke uses his skills to identify problems that need solution	Problem formulation skills
He uses his new found knowledge to solve problems	Problem solving

<table>
<tr><td>Bjarke developed problem solving skills</td><td>skills</td></tr>
<tr><td>Bjarke also chairman of Grenaa</td><td>Bjarke made leader</td></tr>
<tr><td>He is willing to change course to adopt better solutions</td><td>Not rigid in finding solutions</td></tr>
<tr><td>His skills is recognized by people</td><td>Perceived usefulness of Bjarke</td></tr>
<tr><td>He is employed to teach his new found knowledge</td><td>People can employ talent</td></tr>
<tr><td>Being a teacher led him to meet many people</td><td>Bjarkes personal connection</td></tr>
<tr><td>People who could not use PC</td><td>Pc usage problems</td></tr>
<tr><td>People need his help to repair pc</td><td>PC problem</td></tr>
<tr><td colspan="2">Bovl</td></tr>
<tr><td>School used for bovl</td><td>Bovl location</td></tr>
<tr><td>Bovl community is named</td><td>Bovl organization</td></tr>
<tr><td>Bovl grows</td><td>Expansion</td></tr>
<tr><td>Bovl meeting time fixed</td><td>Operation</td></tr>
<tr><td>Bovl enabled the formation of djurslndsnet</td><td>Potential for organization</td></tr>
<tr><td>Bovl presents a potential for wireless organization</td><td>Potential for organization</td></tr>
<tr><td colspan="2">Inspiration Walkie Taklie network</td></tr>
<tr><td>A friends experience with walkie talkie network</td><td rowspan="4">Actual usefulness of walkie talkie</td></tr>
<tr><td>Evidence of low cost of wireless network from walkie talkie</td></tr>
<tr><td>Outdooring of walkie talkie network at bovl</td></tr>
<tr><td>Youngsters play games showing potential usefulness</td></tr>
<tr><td>Inspiration for wireless network from walkie talkie</td><td rowspan="4">Perceived usefulness of wireless network</td></tr>
<tr><td>Perceived usefulness of wireless network from actual usefulness of network</td></tr>
<tr><td>Perceived usefulness of wireless network from actual usefulness of network</td></tr>
<tr><td>Visualization of the future from walkie talkie experiment</td></tr>
<tr><td>Walkie talkie network as persuasion to prepare for Bjarke’s future</td><td>Potential of the wireless future</td></tr>
<tr><td>High speed low cost radio equipment perceived</td><td>Perceived low cost high speed wireless network</td></tr>
<tr><td>High speed low cost perception backed by evidence</td><td rowspan="2">Actual low cost high speed radio</td></tr>
<tr><td>The low cost radio equipment happens</td></tr>
<tr><td>High speed low cost radio equipment expected</td><td>Expectant low cost</td></tr>
</table>

	high speed radio
Preparation in anticipation of low cost radio	Potential low cost high speed radio
Djurslandsnet founded	Djurslandsnet founded
Reason for self-determination of bovl	Self determination
Information portal created-website	Information portal created
Attempt to enlighten people on potential wireless network	Enlightenment campaign
Bovl members helped in the enlightenment	
Challenges with the mobilization of partners	
People did not see the possibility	Difficulty convincing people
There was initial scepticism	Scepticism in Bovl
Municipality not convinced with our idea	Difficulty to convince municipality
Municipality not convinced with our idea	No municipality help
Private sector loved the idea	Fleeting interest from private sector
The private sector could not see the market potential	No ROI potential for private sector
Initially open to any Broadband solution	Open to any Broadband solution
Bjarke opted for a radio solution	Choice of wireless technology
Wi-fi standard was being developed	Immature development of wifi
Wi-fi was cheaper than other wireless	Cheaper cost of wifi
Fixed infrastructure was predominant	Predominant fixed infrastructure
High cost of fixed line connectivity deterred rural connectivity	High cost of fixed line infrastructure
Bjarke designed a low cost access for rural areas	Technical design to facilitate supply push
No perceived usefulness from rural dwellers for connectivity	Low Demand in rural areas
Rural dwellers were poor and unemployed	Low unemployment and poverty in rural areas

Digital divide existed	Low demand in rural areas
Municipality project	
Municipality agenda	Municipality agenda
Bjarke's Prior experience with a small fixed internet project with municipality	Capacity building outcome
Bjarke gained project leadership experience from municipality project	
Bowl community helped in the previous internet project with municipality	Implemented by Bovl
Public funding of municipality project	Public financing
IT expert did not believe in wireless networks	Opposition to wireless
Dispute on which network to adopt for the project	Debate on best technology
Bjarke learnt to be open minded	Open mindedness
Paid IT expert employed to help the internet project with municipality	Outsourcing
Most workers in the municipality project were volunteers	Volunteers
Post municipality project organization process	
Population of djursland	Potential subscribers
Number of household in djursland	
Perceived usefulness of technology debated	Search for an appropriate technology
Technical plan for wireless group developed	Technical planning
Various deployment scenarios was developed	
Research on different scenarios developed	
Cost of the wireless network determined	Estimated expenditure
County providing fiber for hospital connectivity	Public Gateway facilitation
TDC facilitated county fibre	
County funding for fibre optics	
Fibre optics connectivity arrives	Gateway potential
Wireless group want to connect to the fibre	Gateway located
County official doubted groups ability	Failure to attract external help
Low interest from the Danish business association in the wireless	
Attempt to get Djursland business association lead the wireless idea	Attempt at mobilization
Information portal developed	
Conference to bring politicians and business community on board	
Signatures collected to show the demand for the wireless network	Mobilization of citizens
Perceived usefulness of the network shared to the politicians and business	Enticement of

community	politicians and business community
The initial plan was for it to be a PPP	PPP mooted
Previous example of no county help	No county help
No help from banks	No help from banks
No help from parliament and sector ministry	
Parliament favoured market facilitation	
Municipality were not allowed to be involved	
Municipality willing to sign surety but could not	
Copenhagen insists, the market will facilitate the process	No public help
Copenhagen instructs municipality not to help	
Djurslandsnet protest that djursland is not commercially viable	Protest against no public support
From Bovl to Djursland net	
Urban Djursland were high earners	Income assessment
Rural djursland had the potential to do things by themselves	
Meeting for the 625 signatories called to report failure in getting support	Salvage fund raising failure
People were upset with private sector and public sector	Mass anger at public reluctance
People formed union to do it themselves	Convocation
Name for the union (coop) finalized	Formalization of union
Intermediary board formed	Attempt at organization
Previous problem solving skills led the bovl to trust bjarke	Bovl problem solving skills
No one had an idea of how the larger network could be facilitated	Ignorance of huge wireless network
wireless expert advice sought	
Wireless expert advice too expensive	Which wireless solution?
Wireless network could facilitate employment	Potential usefulness of wireless network
Wireless network could lead to user saving money due to low cost	Potential economic usefulness of wireless network
FTTH mooted	
FTTH sustainability was not clear hence dumped	FTTH rejected
Operationalization of Djurslandsnet	
Decentralized from the start	Decentralized organization
Ensure QOS	

Broadband speed sought for Facilitate high uplink Facilitate high capacity usage	Technical requirement
Not Commercial	Purpose of the infrastructure
Bjarkes vision of unity Decentralization adopted to foster equity Slogan fast internet cheap prices attracted people Free network-vision should be free Vision of the network-everyone should have equal service	Vision for network
Self determination	Self determination
Bjarke’s Previous experience with wireless	Previous wireless experience
People signed on online and offline	Subscription portal
Huge membership led to huge economy	Potential economy
Bovl was the central reason the network came about The bovl spirit led people to accept the idea	Existing bovl organization
Bjarke’s Connection to teachers in djursland	Personal networks
Personal contacts led Bjarke to attract people	Personal contacts
Lesson for the 10 household project learnt Potential demand makes it possible for 100 subscription fee	Lesson from test runs
Ingenuity in antenna fabrication to save cost	Intrinsic knowledge
Bjarke had previous management experience	Initiators previous management experience
Bjarke trained as a fine artist Bjarke educated in creative intelligence Bjarke educated in creative intelligence	Bjarkes Previous educational training
Roof s and mast for antennas used Few masts were bought in addition Hills used for repeater stations	Technical resources
Topographical challenges Trees also used for antennas The usage of mast, hills and trees were learnt by coincidence	Natural resources
EU funding came late	Delayed EU funding
Money from EU applied for EU application successful Advice on EU funding Meeting at EU office	Sourcing EU funding

Few technical help outsourced	Technical outsourcing
Staff on secondment are paid	Hiring external help
User subscription paid the remaining bills	Impact of user subscription
EU money bought most equipment	Impact of EU funding
EU money paid for initial access to fibre	Impact of EU funding
EU money pays for 50 percent of amount spent	Impact of EU finance
The loan helped kick start the project	Impact of loan
Three citizens provided loans	Personal contribution
Later people made payment	Financial subscription
EU finally paid	Public Financial incentives
City late to start	Later deployment
Boards created before infrastructure deployment	Djurslands organization
Pilot project to test run of 10 households the wireless idea	
Access fee decided after 10 household project	Network Test run
A small village in nordjurs connected first	
Villages grouped for implementation	Project implementation
Project was implemented in phases	
Subscriber monthly subscription	
Reminder for default subscription	
Non-payment-disconnection	
User returns equipment if he unsubscribe	Subscription planning
Partial cash for access refunded, if unsubscribed	
Subscription agreement	
Volunteers and professionals work together	Cohesive organization
Technical planning	Technical planning
Use of volunteers	Volunteer organization
Volunteer jurisdiction	
Decentralized volunteer system adopted	
Technical volunteers	
Non-technical volunteers	
Decentralized volunteer system adopted	Technical

Technical volunteers	organization
Had to learn traffic routing	Management challenge
Network management-learning by experience	
Learnt traffic management by experience	
Payment of action team not sustainable	
Some work as volunteers and paid staff	Management segmentation
Core action team, part volunteer, part paid	
Legal advice sought	Management of organization
One central board, 8 sub boards	
16 man central board	
Core decentralized action team working with bjarke	
More voluntary IT personnel	
A board is formed	
Technical actors	
Central organ	
Working group	
Every aspect of the board was decentralized	
Union operation is democratic	Mode of operation
Treasury was decentralized	Financial management
Money at centre was used to purchase equipment	Management of procurement
Union operation is democratic	Mode of operation
Population of djursland	Potential subscribers
Number of household in djursland	
Country side, people act for themselves	Understanding country people
Challenge of establishing network in city	Understanding city people
Free spectrum was a huge incentive	Spectrum incentive
Tax refund on equipment-general law	Tax incentive
Users could afford CPEs	CPE affordability
4000 memberships from the start	Huge subscription
Cheaper service-vision achieved	Vision fulfilled
Goal of affordable and accessible infrastructure on course	
Everyone pays equal price	
Level of coverage-connection	Infrastructure penetration
Small union formed	Coop formed

Household penetration coverage	Household penetration today
500 nodes in djursland	Technical network coverage
Project completed	Project completed
Splintered networks are organized in the same way	Pattern of breakup
Municipality reforms enabled break up	Build up to break up
There was disconnect between centre and end customer	
Misconception of number of people paid-problem	
Effort to unify treasury brings problems	
No money sent to the centre afterwards	
Initial low bandwidth led to break up	
Poor quality of service led to break up	
High cost for low quality of service led to break up	
Failure of upgrade to G standard led to break up	
The adoption of expensive ADSL led to break up	
The ADSL agreement exhausted the funds, led to breaking point	
Lack of transparency on the ADSL decision led to break up	
H Standard showed more promise and saved cost	
Lack of information on the upgrades led to the break up	
Lack of transparency on the ADSL decision led to break up	
Now fragmented into 10 networks	Network break up
Break up alliances	Network Fragmentation outcome
The unilateral decision to upgrade to H standard broke up the network finally	Break up
Post Djurslands Net	
Fragmented board still coordinate	Post break up organization
Wireless organization model sustainable	
Coop provided working experience to people	External usefulness
Excess subscription money used for infrastructure expansion	Network expansion
Recognition from political and administrators on success	Public recognition
Aside cities no direct competition	No threat of competition
No threats from ISPs	No competition
WiMAX expensive	Technology not chosen
Pay tax on subscription	Non-tax incentive
Initial subscription hiccup	Financial subscription

	challenge
Commercial competitors are now in Djursland	Market outcome
Most new networks pay low access and subscription fee	Financial plan
Most of the new fragmented network do not pay access fee again	
Coop has a capacity building institute	Sustainability plan
4000 memberships from the start	Huge subscription
Cheaper service-vision achieved	Vision fulfilled
Goal of affordable and accessible infrastructure on course	
Everyone pays equal price	
Level of coverage-connection	Infrastructure penetration
Small union formed	Coop formed
Household penetration coverage	Household penetration today
500 nodes in djursland	Technical network coverage
Project completed	Project completed

Axial Coding Continued

Sub-category 1	**Sub-category 2**	**Main category**
Understanding the innovator		
Previous occupation	Previous occupation	Influences on innovator
Previous educations	Previous educations	
Personal networks	Personal networks	Innovators competences
Democratic thinking	Democratic thinking	
Innovative thinking	Innovative thinking	
Creative thinking	Creative thinking	
Adaptation to failure	Adaptation to failure	
Self-perception	Self-perception	
Visualization	Visualization	
Broad thinking	Broad thinking	
Sense technology potentials	Sense technology potentials	
Conceptualization	Conceptualization	
Exploration	Exploration	
determination	Determination	
Personal Adaptation to mistake	Personal Adaptation to mistake	
Willingness to seek help	Willingness to seek help	
Problem formulation skills	Problem formulation skills	

Problem solving skills	Problem solving skills	
Bjarke made leader	Bjarke made leader	Acceptance as innovator
Not rigid in finding solutions	Not rigid in finding solutions	Perceived usefulness as innovator
Perceived usefulness of Bjarke	Perceived usefulness of Bjarke	
People can employ talent	People can employ talent	
Bjarkes personal connection	Bjarkes personal connection	
Pc usage problems	Pc usage problems	
PC problem	PC problem	
Bovl		
Bovl location	Bovl location	location
Bovl becomes an organization	Bovl becomes an organization	Organized Entity
expansion	Expansion	expansion
operation	Operation	Loose Operation
Potential for organization	Potential for organization	Inspiration for Djurslandsnet
Self determination	Self determination	Will to initiate djurslandsnet
Information portal created	Information portal created	Preparation for Djurslandsnet
Inspiration Walkie Taklie network		
Actual usefulness of walkie talkie	Actual usefulness	Actual usefulness
Actual usefulness of walkie talkie		
Actual usefulness of walkie talkie		
Actual usefulness of walkie talkie		
Perceived usefulness of wireless network	Perceived Usefulness	Perceived Usefulness
Perceived usefulness of wireless network		
Perceived usefulness of wireless network		
Perceived usefulness of wireless		
Walkie talkie unveils wireless future	Walkie talkie unveils wireless future	Potential usefulness of wireless
Perceived cost high speed radio	Perceived cost high speed radio	Perceived supply potential
Actual low cost high speed radio	Actual low cost high speed radio	Actual low cost high speed radio
Actual low cost high speed radio		
Expectant low cost high speed radio	Expected supply potential	Expected supply
Potential low cost high speed radio		

		potential
Potential for organization	Potential for organization	Potential for organization
Djurslandsnet founded	Union formed	coop formed
Enlightenment campaign	Mobilization	Mobilization of partners
Challenges with the idea		
Difficulty convincing people	Internal uncertainty	Challenges in mobilization
Scepticism in Bovl		
Difficulty to convince municipality	Failed public sector mobilization	
No municipality help		
Fleeting interest from private sector	No incentive for private sector	
No ROI potential for private sector		
Open to any Broadband solution	Technology uncertainty	
Choice of wireless technology		
Immature development of wifi		
Cheaper cost of wifi	Perceived cost of wireless	
Predominant fixed infrastructure	Fixed Broadband expensive	
High cost of fixed line infrastructure		
Technical design to facilitate supply push	Perceived low cost wireless solution	
Low Demand in rural areas	Uncertain demand	
Low unemployment and poverty in rural areas		
Low demand in rural areas		
Municipality project		
Capacity building outcome	Capacity building	Capacity building
Implemented by Bovl	Implementation	implementation
Public financing	Public Financing	Public Financing
Opposition to wireless	Search for best technology	Search for best technology
Debate on best technology		
Open mindedness		
Outsourcing	Organization	Organization
volunteers		
Post municipality project organization process		
Potential subscribers	Potential demand	Potential demand
Search for an appropriate technology	Search for appropriate technology	Search for appropriate technology
Technical planning	Technical planning	Technical planning
Estimated expenditure	Estimated cost	Cost
Public Gateway facilitation	Public Gateway	Indirect public incentive

	facilitation	
Gateway potential	Gateway	Connectivity possibility
Gateway located		
Failed Mobilization	Failed Mobilization	Failed Mobilization
No county help	No help	
No help from banks		
No public help	Mobilization efforts	Mobilization efforts
Mobilization of citizens		
Enticement of politicians and business community		
PPP mooted	PPP mooted	Proposed organization
No county help	No help	No help
NO help from banks		
Protest against no public support	Protest against no public support	Protest against no public support
From Bovl to Djursland net		
Income assessment	Potential for ROI	Potential economy
Salvage fund raising failure	Rebuilding trust	Peoples trust
Mass anger at public reluctance	Feeling of rejection	Rejection by public and private sectors
Convocation	Organization	Organization
Formalization of union		
Attempt at organization		
Bovl problem solving skills	Organizations vital resources	Vital resources
Ignorance of huge wireless network	How to facilitate network	Lack of knowledge
Which wireless solution?	Search for wireless solution	Choice of technology
Potential usefulness of wireless network	Argument for wireless	
Potential economic usefulness of wireless network		
FTTH rejected	FTTH rejected	
Operationalization of Djurslandsnet		
Decentralized organization	Vision of network	Vision of network
Technical requirement		
Purpose of the infrastructure		
Vision for network		
Self determination		
Previous wireless experience		

Subscription portal	Vital resources	Vital resources
Potential economy		
Existing bovl organization		
Personal networks		
Personal contacts		
Lesson from test runs		
Intrinsic knowledge		
Initiators previous management experience		
Bjarkes Previous educational training		
Technical resources		
Natural resources		
Delayed EU funding	Regional public funding	Regional public funding
Sourcing EU funding		
Technical outsourcing	Expenditure	Economy
Hiring external help		
Impact of user subscription		
Impact of EU funding		
Impact of EU funding		
Impact of EU finance		
Impact of loan		
Personal contribution	Income	
Financial subscription		
Public Financial incentives		
Later deployment	Implementation	Implementation
Djurslands organization		
Network Test run		
Project implementation		
Subscription planning		
Cohesive organization		
Technical planning		
Volunteer organization		
Technical organization		
Management challenge		
Management segmentation		
Management of organization		
Mode of operation		
Financial management		
Management of procurement		
Mode of operation		
Potential subscribers		

Understanding country people		
Understanding city people		
Spectrum incentive		
Tax incentive	Supply incentive	
CPE affordability		Supply incentive
Huge subscription		
Vision fulfile		
Infrastructure penetration		
Coop formed		Vision fulfilled
Household penetration today		
Technical network coverage	Vision fulfilled	
Project completed		
Pattern of breakup		Pattern of breakup
Build up to break up	Build up to break up	Build up to break up
Network break up	Break up	
Network Fragmentation outcome		Break up
Break up		
Post Djurslands Net		
Post break up organization		
External usefulness		
Network expansion		
Public recognition		
No threat of competition		
No competition		
Technology not chosen		
Non-tax incentive		
Financial subscription challenge		
Market outcome		
Financial plan		
Sustainability plan		Sustainability plan
Huge subscription		
Vision fulfilled		
Infrastructure penetration		
Coop formed		
Household penetration today		Vision fulfilled
Technical network coverage		
Project completed		

Appendix F.1.2 Axial Coding for Magnolia Road Internet Coop

Open code	**Sub-category 1**	**Sub-category 2**
Peak net begins operations	inspiration	Inspiration
Sugarloaf provides radio, Internet		
PPHCP moots on internet access to communities		
George Watson tests radio network at home		
Rob Savoy begins talk with Greg Ching	Informal Idea conception	Conceptual thoughts
Allan Gordon and Paul Kolesnikkof joins	Gathering people	
Rick Cob asks George Watson about his network	Search for potential solution	Search for potential solution
Watson connects to Rick Cob	Initial personal test	Watson Technology trial
George Watson reports 5mbps test from ¼ miles away	Second test	
Another test is made by George Watson	third long distance test	Long range Technology trial
Watson thinks an upgrade will accommodate more people	Test assessment	Result of technological trial
Fourth test between Porters ranch and Twin sisters fail	First public demo test does not produce good signal	Public Long range technological trial
Successful test	Successful third long distance test	
Second public test under snowfall	Successful second public test	
Greg and Gordon express interest in project	Solid interest of founders	Potential usefulness
Invitation sent to more members	Mobilization of members	

Invitation via Puma article	Mobilization of members	Mobilization of members
Invitation via yahoo groups	Mobilization of members	
MRIC explains idea at puma pot luck	Mobilization of people	
MRIC flyers at Puma Pot luck	Mobilization of members	
Search for ISP (T1 provider)	Search for T1 provider	Search for T1 provider
Discussion with Peaknet	Shop for backhaul provider	
Fortis communication chosen as T1 provider	Choice of ISP	
Propagation test done	Technology assessment	Deployment possibility
GPS locations generated	Technology assessment	
Equipment upgrades	Technology assessment	User satisfaction
Tom Plant promises State funding	Potential state funding	State funding possibility
Tom Plant submits application for state funding	Search for state funding	
State funding failed	Unsuccessful state application	Did not qualify for state funds
MRIC is formed	Formation of association	Coop organization
MRIC and sugar loaf begin discussion	Search for Possible Synergies	
Website developed	Information dissemination	
Puma news letter	Information dissemination	
MRIC incorporated	Formalization of association	
Board members had their meeting to make by-laws	Governance	

Rick Cobb orders portable tower for more testing	User non financial donations	Vital resources
Greg Ching provides his house for test	User non financial donations	
Bulk purchase of equipment made	Ready to take off	
George Watson configures base station	Intrinsic knowledge	
George Watson modifies routers to save cost	Intrinsic knowledge	
Congress man cuts sod	Official launch	Official launch
39 trials	Search for expected usefulness	Search for expected usefulness
First successful installation under gusty wind	Backhaul implementation	Expected usefulness
First official trial made	Official trial	
Early subscribers provide 300 dollars seed capital	Seed capital	Member funding
15000 dollars raised	Income raised	
$300 loans from members	Member subscription	
AIG insurance application successful	Insurance provider	Insurance
Fortis provides backhaul connectivity	Outsourcing backhaul maintainance	Private outsourcing
22 subscribers	Users connected	Users connected/actual usefulness
Customers sign up	User connected	
MRIC Merges with Sugarloaf	Actual synergies	Synergic Expansion
MRIC merges with other smaller coops	Actual synergies	

Axial Coding continued

Sub-category 2	Main Category
Inspiration	Inspiration
Conceptual thoughts	Conceptual thoughts
Search for potential solution	Search or Potential solution
Watson Technology trial	Watson Technology trial
Long range Technology trial	Search for expected usefulness
Search for expected usefulness	
Public Long range technological trial	
Potential usefulness	Potential usefulness
Result of technological trial	Expected usefulness
Expected usefulness	
Mobilization of members	Mobilization of members
Search for T1 provider	Search for T1 provider
Deployment possibility	Deployment possibilities
Decision to build a larger network	Decision to build a larger network
State funding possibility	State funding possibility
Did not qualify for state funds	Did not qualify for state funds
Coop organization	Coop organization
Vital resources	Vital resources
Official launch	Official launch
Potential Member funding	Potential Member funding
Insurance	Insurance
Private backhaul outsourcing	Private outsourcing
User Adoption	User Adoption
Expansion	Expansion

Appendix F.1.3 Axial Coding for Hallaryd Coop

Open Codes	Sub-category 1	Sub-category 2
Kommune the initiator	Initiator	Municipality responsibility
Kommune in search of rural associations	Idea transfer from municipality	
Fibre touted as better option	Municipality technology choice	
Commune pays for fibre blowing upfront	Municipality financial responsibility	
Commune maintains the entire network	Municipality responsibility	

No telephones by 2020 – why you should join- need to communicate	Possible telecom scarcity	Possible telecom scarcity
New technology replaces telephone – why you should join- need to communicate	Emergence of new technology	Emergence of new technology
Poor mobile service emphasized	Poor QOS for mobile telephony	Poor QOS for mobile telephony
Call to form association	Mobilization of people	Mobilization
Association informed residents by mail about initiative		
More people invited by working group		
More people invited by working group		
Working group began organizing people		
Young couple organized a meeting in 2012	Hallaryd initiators gather like minds	
Working group formed	Coop ready for action	
More young people than elderly signed up	Early idea adoption	Idea adoption
Coop raised money to pay digger for right of way	Mobilization of funds	Coop income
The old board were not able to provide concrete information	Attempt to form an organizing board	organization
Working group, an assembly of competent people-voluntary	Selection of competent working group	
A more active board was formed	Organizing board formed	
Elections occur every 2 years at annual meetings	Coop democratic process	
The meetings involve the four organizations in may	Annual general meeting	
Volume of potential interest led to the metamorphosis of association to fibre association	Influx of members 20	Growth
More people signed up		
Individuals joined	Coop growth	
To avoid procurement for digging, the association broke into 4- cost savings	Decision not to procure	Cost saving Measures
200k for one organization was not enough, hence it had to be 4	Organization efficiency	
The population Is dispersed so		

having one organization would be too costly		
Shared organization management	Organization efficiency	
Local diggers were preferred to create jobs	Choice of diggers	
35 to 50 member to an organization	Number of members	Growth
Some members need more than one connection	User connectivity need	Actual User need
Internet tv and internet- peoples need	User need	
Elderly alarm-demand aggregation	Perceived user need	Perceived user need
There is quality control on digging	Digging Quality assurance management	Coop management
Coops choose the diggers		
Diggers must be educated		
Coop sources for the diggers		
Members allow digging on their lands –right of way-digger cooperation	Right of way management	
People positive to digging		
People not paid for digging on their land-user acceptance and cooperation		
Fibre expected late summer	Timeline management	
Digging completed nov		
Project on the way	Progress of project	
People are informed via website	Keeping users informed	
People informed via meeting		
People are informed by mail		
People are informed by newspaper ads		
Prompt work to gain people's confidence	Maintain user enthusiasm	
Coop has no office, meet at member house on rotation	Ad-hoc	
Operators tell the coop who is using the service	Coop private sector relationship	Relationship with private sector
Coop reimburses commune upfront payment	Coop reimburses municipality	Coop responsibility
Coop gets service bill from member to pay operator	Coop financial responsibility	
Coop pays 8k skk per month for access to commune fibre		
Eu funds cover part of digging cost	Purpose for EU funding	Public support

Funds from EU agric programme	EU funding	
5k upfront and 20k later	Coop member financial responsibility	Coop expenditure
1.9million sek cost for association	Coop expenditure	
There is enthusiasm about the service	User interest growth	Subscriber response
Fibre handbook helpful in running coop	Source of knowledge	Vital resource

Axial Coding Continued

Sub-category 1	**Sub-category 2**	**Main category**
Municipality initiative	Municipality initiative	Municipality initiative
Idea transfer from municipality	Idea transfer from municipality	Idea transfer from municipality
Municipality technology choice	Municipality responsibility	Municipality responsibility
Municipality financial responsibility		
Municipality responsibility		
No telephones by 2020 – why you should join- need to communicate	Possible telecom scarcity	Possible telecom scarcity
New technology replaces telephone – why you should join- need to communicate	Emergence of new technology	Emergence of new technology
Poor mobile service emphasized	Poor QOS for mobile telephony	Poor QOS for mobile telephony
Mobilization of people	Mobilization	Mobilization
Hallaryd initiators gather like minds		
Coop ready for action		
Early idea adoption	Idea adoption	Idea adoption
Attempt to form an organizing board	Coop formation	Coop formation
Selection of competent working group		
Organizing board formed		
Coop democratic process		
Annual general meeting		
Influx of members	Growth	Growth
Coop growth		
Number of members		
User connectivity need	Actual User need	Actual User need
User need		
Perceived usefulness of technology	Perceived usefulness of	Perceived usefulness of

	technology	technology
Digging Quality assurance management	Coop responsibility	Management
Right of way management		
Timeline management		
Progress of project		
Keeping users informed		
Maintain user enthusiasm		
Ad-hoc		
Organization efficiency	Cost saving measures	
Organization efficiency		
Choice of diggers		
Decision not to procure		
Coop member financial responsibility	Coop expenditure	
Coop expenditure		
Mobilization of funds	Coop income	
Coop private sector relationship	Relationship with private sector	Relationship with private sector
Coop reimburses municipality	Manageable Coop responsibility	Manageable Coop responsibility
Coop financial responsibility		
Purpose for EU funding	Public funding	Public funding
EU funding		
User interest growth	Subscriber response	Subscriber response
Source of knowledge	Vital resource	Vital resource

Appendix F.2: Axial Coding Process for Developing Countries

In this process, the open codes identified earlier are grouped for each developing country case. The relevant codes that identify the process of implementation are grouped. The codes that do not identify the process of implementation are dropped. For a code to be identified as leading towards implementation, it has to either be an intention leading to an action or interaction, an action or an event. However a will be seen in the categorization process, some of these relevant, intentions, actions and events being coded undergo an elimination process, if it does not lead towards implementation.

Appendix F.2.1 Axial Coding for JAWUG

Open Codes	**Memo 1**	**Sub-category 1**	**Memo2**
Initiators	They had the vision of establishing the network for themselves	Actors	Initiators of Force of action
Perceived usefulness of service		Perceived usefulness of service	Usefulness of the service, to the actors
Platform to play games	The initiators understood why they needed the network	User needs assessment	Initial needs
Platform to collaborate on a school assignment			
Needed cheap network solution	The existing Broadband infrastructure and service was costly	Service affordability	
Need for affordable network	The existing Broadband infrastructure and service was costly		
Need to Interconnected network with other networks	The growth and emergence of sister networks led to the need for interconnectivity	External Network Accessibility	
Had use of network	The initiators already knew which network solution they wanted	Perceived Usefulness	Why the initiators went for Wi-Fi
Know **potential** of Wi-Fi network	The initiators were computer science		

	students with knowledge of wireless networks		
Comradeship	The initiators were united in their action and they also had friends who wanted to share in the network		
Technical **knowledge**	The initiators were computer science students with knowledge of wireless networks	Intrinsic knowledge	Initiator's resource
Free spectrum	The initiators had technical resources they could afford	Free resource	
Affordable technical resources to establish network	The initiators had technical resources they could afford	Equipment Affordability	
First test	At the different stages of growth and expansion, the initiators and the new volunteers embarked on trials to understand the scope of expansion of the network	Experiment	Initiators test their ideas
Low level of connectivity	These were the problems experienced by the initiators as well as the others who opted for the connectivity provided by the initiators. This implies unavailability	Service Unavailability	Catalyst for the initiator's needs
low availability of existing technology			
Unaffordable existing technology		Service unaffordability	
Wi-Fi preferred	Wifi chosen because WiMAX was unaffordable	Infrastructure affordability	Choice of technology to be used
Initial Wi-Fi connection	At the different stages of growth and expansion, the initiators and the new volunteers embarked	Technology feasibility confirmed	Confirmation of the suspicion of the initiators

	on trials to understand the scope of expansion of the network		
Wireless connectivity	Wireless connectivity	Confirmed usefulness	
Wi-Fi produced Fast wireless data rates	The initiators experienced download speed as high as 11mbps. This confirmed the usefulness of the wi-fi to meet their needs. This implies connectivity		
invite their friends and street neighbours	The neighbours were willing to go along with the idea of being connected without any formal corporation. Hence, they had the cooperation spirit	Actual usefulness	Concrete evidence on the usefulness of technology
identifies efficiency of the network	The efficiency of the network was evident at every stage of expansion leading to greater connectivity		
People of like minds (street neighbours)	The neighbours were willing to go along with the idea of being connected without any formal corporation. Hence, they had the cooperation spirit	Cooperation	Enlarged cooperation between the initiators and the early adopters and Early Majority
People of like minds	The neighbours were willing to go along with the idea of being connected without any formal corporation. Hence, they had the cooperation spirit		
Network growth by word of mouth	The efficiency of the network led to the	Growth	Subscription growth and

Expanded the network	informal verbal advertisement of the network leading to greater need for connectivity and eventual connectivity		infrastructure expansion
Initial High adoption	Critical mass was amassed based on the emergence of merging of sister networks and the growth of the clientele. This led to the need to form an organization that will manage the network. JAWUG is born		
Management's formation to formalize organization	Critical mass was amassed based on the emergence of merging of sister networks and the growth of the clientele. This led to the need to form an organization that will manage the network. JAWUG is born	Organization	Formation of organizational hierarchy to manage the expanding network
Management election			
Management organization			
Management working group			
Decentralized management in each area			
JAWUG is formed			
Volunteer oriented	The new group decided on the specifics of the organization	Operations	Network Operations
No volunteer remuneration			
Membership sign-up fee			
Membership control			
Annual membership subscription			Financial organization
Membership sign-up fee	The new group decided on the specifics of the organization	Internal Income	
Annual membership subscription	The new group decided on the specifics of the organization		
Few streams of income	The organization decided on the income structure of the	External Income	
Incentive from hardware suppliers			

Donation from private sources No loans	organization		
Traffic routing to other networks No interconnection fee ISPs provide free bandwidth	The need arises for JAWUG to interconnect with other wireless networks as they are not able to connect with PSTN, based on the restriction from South African Government. This implies interconnectivity challenge. ISPs provide free bandwidth	Interconnectivity	Secondary issues, not too necessary
The need to interconnect to other Wi-Fi networks	Competing networks exist	Enlarged network need	
Similar networks exist	Competing networks exist	Competing networks	
Advice from technocrats (ISPs etc.)	Source for technical knowledge on how to interconnect. This is technical consultancy	Technical consultancy	
No public assistance Attempt to reach out to government Discouraged by bureaucracy Government regulation does not support transit with telcos	No public support. Failed attempt at PPI or PPP	Public Support	Since there was no public support, its relevance to the final hypothesis is slim
Decided against government help	No public support. Failed attempt at PPI or PPP	Self determination	Identified vital resource
so far no support from telcos	Regulatory challenges led to interconnectivity challenges and also limited public support	No External support	Search for external support
Transit with telcos not allowed	Regulatory challenges led to interconnectivity challenges and also	Interconnectivity threat	Interconnectivity war

	limited public support		
No accountability issues	JAWUG has been able to weather internal management crises.	Accountability threat	
Disagreement does occur	JAWUG has been able to weather internal management crises.	Disagreement resolution threat	Conflict resolution
Management of dispute resolution			
They work together			
Problem resolution			
The process is expensive	Expenditure	Expenditure	Financial organization
High cost of upgrades			
It is an urban network	Location	Location	Status of network
Cheap mobile Broadband, competing with the network	Threat from mobile Broadband competition	Threat from mobile Broadband competition	Competition from Network operators
Mobile Broadband provides better data rates			
Inconsistent volunteers	Organizational threat	Organizational threat	Threats to JAWUG
Project at peak			
WiMAX unaffordable	Wifi chosen because WiMAX was unaffordable	Infrastructure unaffordability	High cost of WIMAX
Rural subscription not successful	Failed attempt to deploy in rural Johannesburg due to low adoption	Low adoption in rural areas	Challenges to rural penetration
Network extended to rural areas			
Roll out tothe rural area is slow			
Cost, education, technical knowhow lacking in rural areas	Inhibitions to Broadband adoption in rural Johannesburg	Threats to rural adoption	Challenge of deploying in rural areas
Broadband, not a priority here			
Rural network a good initiative	Opinion	Opinion	Interviewees opinion
Community networks can work	Incentive needed for rural penetration of wireless Broadband		
Support from public sector needed for rural	Incentive needed for rural penetration of wireless Broadband	Incentive	Solution to rural deployment

Late organization of coop Delayed initial strategy for development	Regret for late organization of coop	Organization	Lesson learnt from hindsight

Axial Coding Continued

Sub-category 1	**Sub – Categories 2**	**Main Categories**	**Memo**
Actors Cooperation Organization Operations	Actual infrastructure development	Actual infrastructure development	Management of the implementation process
User Need (phase 1) Need for service affordability Need for Equipment Affordability (phase2) Need for External Network Accessibility Enlarged network need Interconnectivity (phase 3)	User need assessment	Intention to develop infrastructure	Need to be met at the various phases
Need for External Network Accessibility Enlarged network need Interconnectivity	Potential for growth	Potential for growth	Potential for mass patronage
Perceived Usefulness of technology	Perceived Usefulness of technology	Perceived Usefulness of technology	Perceived usefulness leads to trial, confirmed usefulness confirms perceived usefulness, actual usefulness occurs after implementation
Perceived usefulness of service	Perceived usefulness of service	Perceived usefulness of service	
Confirmed usefulness of technology	confirmed usefulness of technology	confirmed usefulness of technology	
3. Initial Wi-Fi connection	Technology feasibility confirmed	Technology feasibility confirmed	
Actual usefulness	Actual usefulness	Actual usefulness	

Intrinsic knowledge	Knowledge	Vital Resources for technical test	Tools to meet the needs at the various phases
Technical consultancy			
Self determination	Self Determination		
Free resource	Technology potential		
Infrastructure equipment affordability			
Internal Income	Income generated		
External Income			
Service test result	Service test result	Confirmed usefulness of service	
Experiment	Technology trial	Trial	Attempt to meet need
Service scarcity	Potential	Existing service Scarcity	Catalyst for need that runs through all the phases
Service unaffordability			
Growth	Growth	Growth	The end result
			These factors did not affect the JAWUG formation process. However they are kept to facilitate comparison with other coded cases.
Public Support	Potential vital resource	Potential vital resource	
External support			
Competing networks	Competing network		
Interconnectivity threat	Threat		
Accountability threat			
Organizational threat			
Disagreement resolution threat			
Expenditure			
Location			
Threat from mobile Broadband competition	Threat		
Infrastructure unaffordability	Problem with existing technology		
Low adoption in rural areas	Demand		
Threats to rural adoption			
Opinion			
Opinion			
Incentive			
Organization			

Appendix F.2.2 Axial Coding for Pre-Commercial phase of AirJaldi (Dharamsala)

Open Codes	Sub-category	Main Category
NGOs have need of ICT connectivity to enable information sharing	Demand	Demand
Yahel goes to live in India	Recruitment of technical expertise	Recruitment of technical expertise
Yahel opts for wireless connectivity	Perceived usefulness of technology to innovator	Perceived usefulness of technology to innovator
NGOs contact Yahel in the US	Recruit help	NGO’s vital resource
NGO Vsat	Technical resource	
Yahel commits his personal resources to develop connectivity	Personal resources	Yahels Vital resources
Yahel adopts his previous knowledge of setting up networks to facilitate connectivity	Knowledge	
Yahel has a passion for rural connectivity	Personal interest	
Yahel tests different wireless networks	Trial	Trial
Yahel tries international calls with his network	Confirmed perceived usefulness of technology	Confirmed perceived usefulness of technology
Yahel begins connecting the NGOS	First phase of connectivity	First phase of connectivity
In 2005 India deregulates Wi-Fi spectrum	Indirect public incentive	Indirect public incentive

Appendix F.2.3 Axial Coding for Commercialization phase of AirJaldi

Open Coding	Sub-category 1	Sub-Category 2
Initiator	Main Actor	Management Process
Identification of possible users	Actor recruitment	
Gathering of like minds	Actor recruitment	
Financial/managing actors induced by positive experiment	Recruited actors form management	

Recruitment of like minds	Staff recruitment	
Personal knowledge of radio networks	Intrinsic Knowledge	Knowledge
Knowledge on how to facilitate network	Intrinsic Knowledge	
Social project	Initial Purpose setting	Purpose
Purpose rural wireless	Technology Purpose setting	
Commercial entity	Commercial purpose setting	
Free Wi-Fi Spectrum	Free network resource	Network resources
Potential of network to rural areas	Network potential	
Technical feasibility of network in rural areas	Network possibility	
Experiments by initiator	Experiment	Trial
Positive experiment outcome	Expected outcome	Expected usefulness
Positive outcome publicized at conference	Expected Outcome publicity	Publicity of expected usefulness
Help from schools and ICT teachers	External support	External human resource
Help from westerners	External support	
User need for Network Effect	User need assessment	User need assessment
User need for information		
User need for academic study aid		
User need for entertainment		
User need assessment via economic activities		
User need assessment via Google earth		
User need assessment via site survey		
Threshold economic activity		
Tourist to Dharamsala need internet		

Dharamsala was economic disadvantaged		
crowded village makes it easier to deploy wifi	Demand potential	Perceived demand
More customers in rural and semi-rural areas	Potential demand	
Rural areas need Broadband more	Potential user demand	
Plans to role out in core rural areas	Potential demand	
Rural dwellers mostly farmers	User occupation	
School as anchor tenant	Anchor tenant	
Anchor tenant-rural bank	Anchor tenant	
Demand exists in rural areas	Potential user Demand identified	Identified demand
Rural areas in need of Broadband	Potential user Demand identified	
School as anchor tenant	Anchor tenant	
Anchor tenant-rural bank	Anchor tenant	
Low population density in rural areas	Population	Potential commercial incentives to invest
Crowded settlement	Settlement pattern	
Some form of social amenities	Social amenities	
School as anchor tenant	Anchor tenant	
Anchor tenant-rural bank	Anchor tenant	
User ability to pay	User ability to pay	
Rural dwellers mostly farmers	User occupation	
People want to talk	User demand	Actual user demand
People want to send email	User demand	
Setting organizational plans	Planning	Planning

Gathering of like minds	Actor recruitment	
Financial/managing actors induced by positive experiment	Recruited actors form management	
Recruitment of like minds	Staff recruitment	
Rural areas vary	Type of rural area	
Not the poorest of the poor	Type of rural area	
No public funding	No public financial support	Funding
Private capital injection	Private financial support	
No needs assessment		
Help from schools and ICT teachers	External support	External source
Help from westerners	External support	
Network growth, 5 networks	Growth	Growth
No network decline so far	Growth	
Dharamsala network one of the largest in the world	Growth	
Renewable energy used in rural areas to save cost	Green energy solution	
Technology of choice wi-fi	Wi-fi cheaper	Cost of technology deployment
Wi-Fi equipment is affordable	Wi-fi affordable	
Wimax equipment is expensive	WiMAX expensive	
Wimax spectrum is not free	No free wimax resource	
Wimax operations is expensive	WiMAX expensive	
Operate under a sub-ISP licence	Low entry barrier	Public incentive
ISP licence now reduced	Low entry barrier	
Bandwidth redistribution	Business model	Business Model

Mostly post-paid payment model	Payment plan	
We are customers to telcos -	Support from telcos	Bandwidth source
Possible public funding via universal service funds	Potential public support	Potential public support
Not big enough to get the funds	Not qualified for public support	
Currently supply internet access to buildings	Current customers	Actual usage
Currently supply internet access to businesses	Current customers	
There is competition in the cities and non in rural-areas	Competition in cities	Competition assessment
Not afraid to co-exist with new competition	Plan for future competition	
Less competition in rural areas	Level of competition	

Axial Coding Continued

Sub-category 1	**Sub-category 2**	**Main Category**
Initial Purpose setting	Business modelling	Business modelling
Technology Purpose setting		
Commercial purpose setting		
Main Actor	Management	Implementation process
Actor recruitment		
Actor recruitment		
Recruited actors form management		
Staff recruitment		
Planning	Planning	
Actor recruitment		
Recruited actors form management		
Staff recruitment		
Business model	Business Model	
Payment plan		
Intrinsic Knowledge	Knowledge	
Intrinsic Knowledge		

Free network resource	Network resources	Vital resources
Network potential		
Network possibility		
External support	External human resource	
External support		
No public financial support	Financial sustainability	
Private financial support		
Support from telcos	Bandwidth source	
Experiment	Trial	Trial
Confirmed usefulness	Confirmed usefulness	confirmed Usefulness
Expected Outcome publicity	Publicity of expected usefulness	Advertisement
User need assessment	User need assessment	Demand Assessment
User need assessment		
User need assessment		
User need assessment		
User need assessment		
User need assessment		
User need assessment		
User need assessment		
User need assessment		
User need assessment		
Demand potential	Perceived demand	
Potential demand		
Potential user demand		
Potential demand		
User occupation		
Anchor tenant		
Anchor tenant		
Potential user Demand identified	Identified demand	
Potential user Demand identified		
Anchor tenant		
Anchor tenant		
User demand	Actual user demand	
User demand		
Low entry barrier	Low Market entry Barrier	
Low entry barrier		
Population	Potential commercial incentives to invest	
Settlement pattern		
Social amenities		
Anchor tenant		
Anchor tenant		

User ability to pay		Supply assessment
User occupation		
Type of rural area	Type of rural area	
Type of rural area		
Competition in cities	Competition assessment	
Plan for future competition		
Level of competition		
Green energy solution	Technology Assessment	
Wi-fi cheaper		
Wi-fi affordable		
WiMAX expensive		
No free wimax resource		
WiMAX expensive		
Potential public financial support	Potential Public funding	
Not qualified for financial public support		
Current customers	Actual usage	Usage
Current customers		
growth	Growth	Growth
growth		
growth		

Appendix F.2.4 Axial Coding for Wireless Ghana Project

Open Coding	**Sub-category 1**	**Sub-category 2**
Had the vision to become an ISP	Personal Vision	Initiator Characteristics
Workers from IT section of centre were Johns first converts	Ability to mobilize	
IT department liked the idea	Ability to recruit	
John motivated by credit as a peace corps volunteer	Initiator personal interest	
A westerner led the initiative, peace corps	He is External initiator	
John did tests to convince the NGO management	Ability to persuade	
He John led the test runs funded by him		
John did tests to convince the NGO management	Proof of expected usefulness	Expected usefulness
He John led the test runs funded by him		

Initiator of project	Lead actor	Lead actor
NGO-vehicle organization	Operational management	Management
NGO was a community centre	Purpose of NGO	Purpose of NGO
Community centre served Akuapim ridge		
Cblit set up apredie resource centre		
Redundant Vsat	Presence of gateway	Vital resource
Vsat originally meant for the schools		
Community centre owned the computer lab	Asset of NGO	
Community centre owned a library		
NGO had a telecentre as ICT hub and capacity building	Operational resource	
Potential of the usage of telecentre prompted demand		
John planned the project before coming	Initiators intrinsic knowledge	
Organizations paid per node	Business model	Purpose setting
Bandwidth redistribution-business model		
Initiative carried out to help sustain library	Purpose of wireless group	
Convenient email transactions-convince less interested users	Perceived usefulness	Perceived usefulness
Globalization- convince less interested		
Potential users thought of cost	Service, Affordability	Consumer interest
Potential users wanted free service		
First rural wireless initiative In Ghana	An innovation	An innovation
Market Research led by initiator and team	Market research	Demand assessment
Low level of education	Literacy assessment	
Resident are mostly farmers	Occupation assessment	
Educated ones live in nearby towns	Literacy assessment	
Low level of income	User Income assessment	
Low basic amenities	Amenity assessment	
Not the poorest of the poor	Poverty assessment	
Churches		
Organizations		
International organizations		

Micro finance banks	Anchor tenants	
Rural banks		
Small hotels		
Local restaurants		
District office		
Small business		
NCS ISP bandwidth provider	Bandwidth provider	Supply assessment
Teledata ICT, later ISP when NCS folded up		
billing system installed at client end	CPE need	
billing software was initially affected by inconsistent power supply		
One node offered free	Subscription special offer	
No access fee		
Customer only bought CPEs, but CPU was given free		
CPU given to them free		
Wireless solution identified as cheaper	Choice of technology	
Initiative killed by teledata ict competition	Emergent competition	Emergent competition
teledataICT was expensive, hence could not sustain operations	End of destructive competition	Death of competition
no help from district education hotels had few customers, hence low demand	Low demand	Demand assessment result
hotels had few customers, hence low demand		
door to door meeting asking for connections	Demand soliciting Garnering interest Mobilization of clients	Demand soliciting
Interested, on interested clients		
Effort made to convince sceptics to join up		
interested clients got proformal invoice indicating cpe they need	Early user adoption	User adoption
high monthly subscriptions fee	High subscription fee	Supply Barrier
lower subscription fee if subscriber lives close to community centre		
higher subscription if lived farther from community centre		
cost disparity based on equipment needed and distance	High cost of installation equipment	

high wholesale cost of bandwidth 407 dollars a month	High Expenditure	
Had challenges with sustainability	unsustainability	Decline
Sustainability affected by clients not paying their bills		
Bandwidth of 128kbps to 512kbps	Low Data rates	
Income less than expenditure	Loss	
Users consumption of higher bandwidth led to reduction in cost	Bandwidth consumption	
low bandwidth 1mb redistributed	Insufficient bandwidth	
the only interest of the ngo was to bridge digital divide	Project out of NGO scope	
wireless Ghana was out of scope for the NGO		
Teledata ict, latter competitor	Destructive competition	
Streaming and downloading led to bills users could not pay	Actual user need	Actual user need
Users were downloading		
Users streamed Youtube		
NGO were skeptical of Johns ideas as a result of the mountains	NGO Skepticism	Initial NGO reluctance
First test on a church	First test	Trial
John did tests to convince the NGO management	Persuasion of NGO management	Management Persuation
He John led the test runs funded by him		
Initially GSM signal was poor	Bad QOS of existing technology	Scarcity
high wholesale cost of bandwidth 407 dollars a month	High expenditure	Management
John led the management of the project supported by IT staff	Project management	
client payment went to the centre	Income	
major funding from clients, full commercial entity		
private sector participation discouraged by parent NGO	Potential private sector support	Potential External support
there was interest in the project from the world bank	Donor interest	
finance from the world bank was to fund case study research on the project		
no help from district assembly	Potential Public support	

Central government wanted to use the initiative as a hub		
parent NGO organizes ICT training-capacity building	Capacity building	Demand facilitation
UNDP provided ICT training at NGO		
NGO provided the free CPUs	Provision of incentives	
Village willing to use its resources to sustain the project	High village interest	Potential organizer
Had challenges with sustainability	Unsustainability	Unsustainability
Sustainability affected by clients not paying their bills		

Appendix F.3: Axial Coding Process for Almhult Municipality Broadband Initiate (Developing Country 2)

In this process, the open codes identified earlier are grouped for the Almhult Municipality Broadband Initiative - developing country case 2. The relevant codes that identify the process of implementation are grouped. The codes that do not identify the process of implementation are dropped. For a code to be identified as leading towards implementation, it has to either be an intention leading to an action or interaction, an action or an event. However a will be seen in the categorization process, some of these relevant, intentions, actions and events being coded undergo an elimination process, if it does not lead towards implementation.

Open coding	**Sub-category 1**	**Sub-category 2**
Area commercially unviable to commercial entity	Commercially disinterest	Motivation to intervene
Poor mobile reception in most areas	Bad QOS	Motivation to intervene
Poor user satisfaction to current mobile service	Bad user experience	Motivation to intervene
A small city surrounded by villages	Size of village	Motivation to intervene
Municipality workers are stationed in villages	Municipality station connectivity	Purpose
Political decision to connect municipal workers to Almhut with fibre	Political will to connect	Intention to develop infrastructure
Purpose, connect municipality stations	Municipality station connectivity	Purpose
Municipality fibre proximity to people	Connectivity proximity	Purpose
Possibility for people to connect	Perceived usefulness	Perceived usefulness
Bigger communities expect government lead of supply	Community expectation from municipality	Coop response
Smaller communities take initiative	Community initiative	Coop response
Operating terms by municipality	Purpose setting by municipality	Operational design
Fibre backbone owned by the community	Infrastructure ownership	Infrastructure delineation
Access point connectivity	Infrastructure ownership	Infrastructure delineation

owned by parishes		
Parishes organize in form of coops	Coops organization	Expectation from coop
Municipality delivers fiber , equipment and technic houses	Duty of municipality	Expectation from municipality
Community connect their fibre to technic houses	Duty of the coops	Expectation from coop
Municipality purchase coop needs for coop	Duty of municipality	Expectation from municipality
Coop pays	Income for municipality	Financial expectation from coop
Demarcated parishes own coops	Coop organization	Coop Delineation
Coop demarcation based n old church organization	Coop organization	Coop Delineation
9 coops registered	Coop organization	Coop Delineation
5 coops started their project 5 years before municipality decision	Prior Coop initiative	Coop action
Fixed and mobile infrastructure damaged by storm	Storm repercussion	Motivation to form coop
Telia decided not to rebuild	Storm repercussion	Motivation to form coop
Damage too expensive for telia	Storm repercussion	Motivation to form coop
Telia equipment too old	Storm repercussion	Motivation to form coop
Low population	Commercial disinterest	Motivation to intervene
Low population of permanent residents	Commercial disinterest	Motivation to intervene
Temporary residents own summer houses	Commercial disinterest	Motivation to intervene
Telia had no USO	Lack of USO	Motivation to intervene
Telia offers temporary mobile solution	Bad QOS	Motivation to intervene
Unsatisfactory service with mobile solution	Bad user experience	Motivation to intervene
Telia eventually supply's mobile	Level of commercial activity	Motivation to intervene
About Half households to be connected at first phase	Target setting	Planning
Coop interest higher in smaller parishes than the bigger ones	Expectation of coops	Coop response
About 50 percent response in	Coop response	Coop response

bigger parish		
70 to 80 percent response in smaller parishes	Coop response	Coop response
Knowledge of fibre development by some coop chairman	Extrinsic knowledge of technology	Vital resource
Chairmen of active coops invited to speak at the big parishes -to ginger interest	Municipality generation of interest	Idea transfer
Cross coop activities occurred at municipality office in almhult	Municipality generation of interest	Idea transfer
Coops were formed along some existing organization – meeting of friends	Coop organization	Coop idea reception
Municipality located such organizations	Municipality's attempt to start coop	Coop idea reception
Early adoption was slow		
Coops operate with volunteers	Coop organization	Coop organization
Municipality plan to train the volunteers on technology - sustainability	Future plans - sustainability	Sustainability
Storm catastrophy used to elicit interest	Storm repercussion	Motivation to form coop
Obsolete technology idea used to elicit interest	Change in technology	Motivation to form coop
Lack of spare part for the then obsolete equipment	Obsolete technology	Motivation to form coop
There will be no infrastructure besides the poor mobile service	No infrastructure threat	Motivation to form coop
There is no form of government in the parishes	Organization dilemma	Coop delineation
Chairmen from organizations asked to elicit interest from friends and neighbours	Municipality generation of interest	Idea transfer
Storm of 2005-motivation for formation of coop	Storm repercussion	Motivation to form coop
Court decided telia had no uso –motivation for coop	Storm repercussion	Motivation to form coop
Potential of no reliable infrastructure-motivation for coop	No infrastructure threat	Motivation to form coop

Municipality influenced by the existence of municipality action up north-municipality motivation	Lesson from other municipalities	Vital resource
Fibre is the best Broadband carrier= cost not an issue	Choice of technology	Choice of technology
Rare spare parts for wireless	No to wireless technology	Lesson from earlier initiative
Wifi does not provide the same data rates	No to wireless technology	Lesson from earlier initiative
Municipality facilitated project	No to wireless technology	Lesson from earlier initiative
No complaints from network operators	No competition	Motivation to form coop
EU rules permit municipality facilitation of telecom infrastructure	Public policy initiative	Public support
Coops get subsidy from Eu	EU Subsidy for coop	Public support
Telia not providing fibre connectivity in communities at the moment	No competition	Motivation to form coop
Zitius handles management and operation of municipality fibre= private sector involvement	Management and operations	Management and operations
Zitius facilitates the technical equipments	Management and operations	Management and operations
Zitius provides customer support	Management and operations	Management and operations
Zitius facilitates a consortium of Broadband service providers	Management and operations	Management and operations
Municipality decides the number of service providers needed by zitius	Purpose setting by municipality	Planning
Fibre backbone is municipality financed	Municipality financial obligation	Municipality financing
Tele 2 is gateway to Almhult	Gateway infrastructure provider	Planning
Municipality fibre gains access from tele 2 infrastructure	Backbone operations	Planning
User subscription expected to be affordable	Service affordability	Affordability
Coops pay monthly access fee to access municipality backbone	Municipality income	Municipality gain

Municipality handles the maintains of the backbone via zitius	Municipality Infrastructure ownership	Municipality ownership
Zitius provides 24/7 support service	Management and organization	Management and organization
Coops pays municipalities for Zitius services to the coops	Private sector income	Private sector gain
Monthly connectivity for maintenance of network	Municipality ROI	Municipality ROI
Coops pay enbulk to service providers	Private sector income	Private sector Gain
Broadband service providers decide on the service they provide	User choice	Affordability
Telia wanted a monopoly in service delivery	Failed procurement	Procurement
Open tender was made and Zitius was choosen	Successful procurement	Procurement
There is a platform for users to pick the service provider- user choice	User choice	Affordability
Project has a clear timeframe for each case	timeline	timeline
EU funding goes directly to the coops	Coop income	Coop income
EU funding covers close to 50percent of total cost	Coop income	Coop income
Flat rate for user access	Coop income	Coop income
County disburses EU funds	EU Public funding	Coop income
Funding and access cost equality ensured	Coop income sustainability	Coop expenditure
Municipality sends monthly bill for access to its backbone to coops	Municipality billing	Municipality billing
Monthly fee pays for material fibre blowing and access to municipality fibre	Municipality billing	Municipality billing
Municipality invests 40 mill skk in project	Municipality financial obligation	Municipality funding
Monthly access fee helps municipality recoup cost	Sustainability	Sustainability
User need determined based on request based demand pull-	Demand pull	Motivation to invest

--- municipality determination of need		
50 percent of population is needed for request to be adhered to ------municipality determination of need	Decision for municipality investment	Motivation to invest
Municipality also makes		
Almhult residents are medium income earners (2000 dollars a month before tax	Citizen income	Ability to pay
High income earners from ikea	Citizen income	Ability to pay
50 percent with 2 families working fulltime	Citizen income	Ability to pay
No threat from telia as there is no service competition on their infrastruture	No competition	Motivation to invest
Demand aggregation facilitated by national and regional government	Demand aggregation	Sustainability
Connection without usage, you need to pay annual coop membership fee	Coop connectivity management	Coop connectivity management
Coop annual membership fee-sustainability	Coop income	Coop income
Coops make decision on future connectivity to users	growth	growth
If current operator becomes expensive then a new operator will be employed	Ensure service affordability	Affordability
The infrastructure is expected to be owned by the municipality to protect public interest	Infrastructure ownership	Planning
Threat of ful corporatization-municipality against it-sustenance	Sustainability	Sustainability
Infrastructure will be outsourced till the foreseeable future	Sustainability	Sustainability
Municipality does not have the technical knowhow to manage infrastructure	Municipality capacity to manage infrastructure	Municipality limitation
Municipalities up north can't	Lessons from other	Vital resources

facilitate opennet –lesson from up north	municipalities	
Competition promoted by short contracts-- sustainability	Service Affordability	Affordability
coops can apply for more money if they exhaust their funds	Coop funding sustainability	sustainability
Municipality can loan coop money if they run out	Coop funding sustainability	sustainability
Municipality operation handled by small staff	Municipality coordination	Municipality coordination
Coops and landowners determine right of way in their areas	Coop right of way	Coop activity
Swedish broad of roads decide right of way along the bigger roads	Coop right of way	Cop activity
Swedish law permits municipality facilitating telecom facility with tax payers funds	Public policy incentive	Public support
Swedish law does not permit municipality operating telecom facility	Public policy prohibition	Limitations of public support
Municipality relationship with private company reviewed every 3 years	sustainability	sustainability
No Prior experience with fibre deployment	Extrinsic knowledge	Vital resource

Axial Coding Continued

Sub-category 1	Sub-category 2	Main Category
Political will to connect	Political will	Political will
Perceived usefulness	Perceived usefulness	Perceived usefulness
Efficiency of technology	Efficiency of technology	Efficiency of technology
Prior Coop initiative	Prior Coop initiatives	Prior coop initiatives
Municipality Infrastructure ownership	Infrastructure delineation	Planning
Infrastructure ownership		
Infrastructure ownership		
Municipality station connectivity	Purpose	
Municipality station connectivity		
Connectivity proximity		
Purpose setting by municipality		
Demand aggregation	Sustainability	
Sustainability		
Sustainability		
Sustainability		
Future plans - sustainability		
sustainability		
Timeline	Timeline	
Gateway infrastructure provider	Interconnectivity	
Backbone operations		
Coop organization	Coop Delineation	
Coop organization		
Coop organization		
Organization dilemma		
Coops organization	Coop responsibility	
Duty of the coops		
Duty of municipality	Municipality responsibility	
Duty of municipality		
User choice	Affordability	
User choice		
Ensure service affordability		
Service Affordability		
Private sector income	Private sector gain	

Private sector income		
Private sector income	Private sector gain	Private sector gain
Private sector income		
Demand pull	Motivation to intervene	Motivation to intervene
Decision for municipality investment		
Bad user experience		
Size of village		
Commercial disinterest		
Commercial disinterest		
Commercial disinterest		
Lack of USO		
Bad QOS		
Bad user experience		
Level of commercial activity		
No competition		
Extrinsic knowledge of technology	Vital resource	Vital resource
Lessons from other municipalities		
Lesson from other municipalities		
Extrinsic knowledge		
Municipality generation of interest	Idea transfer	Idea transfer
Municipality generation of interest		
Municipality generation of interest		
Public policy incentive	Regional Public support	Public support
Public policy initiative		
EU Subsidy for coop		
Municipality financial obligation	Municipality funding	
Municipality financial obligation		
Public policy prohibition	Limitations of public support	Limitations of public support
Municipality billing	Municipality ROI	Municipality ROI
Municipality billing		
Municipality income		
Income for municipality		

Private sector income	Private sector ROI	Private sector ROI
Private sector income		
Expectation of coops	Coop response	Coop response
Coop response		
Coop response		
Municipality financial obligation	Municipality funding	Motivation to create coop
Municipality financial obligation		
Storm repercussion	Motivation to form coop	
Change in technology		
Obsolete technology		
No infrastructure threat		
Storm repercussion		
Storm repercussion		
No infrastructure threat		
No competition		
No competition		
Citizen income	Ability to pay	
Citizen income		
Citizen income		
Coop connectivity management	Coop connectivity management	Coop management formation
Coop right of way	Right of way management	
Coop right of way		
Coop income	Coop income	
Coop income		
Coop income		
Coop income		
EU Public funding		
Coop income sustainability	Coop expenditure	
Management and operations	Private infrastructure Management and operations	Management and operations
Management and operations		
Management and organization		
Growth	Growth	growth
Municipality capacity to manage infrastructure	Municipality limitation	Municipality limitation
Municipality management	Municipality coordination	Municipality coordination

Appendix G. Selective Coding Process

In this section of the Appendix, the selective coding thought process is expressed diagrammatically. Here an attempt is made in pondering through the processes that emerge from the linking of relevant categories. This process is more implicit than explicit. However, in this section, diagrams are used to outline some relevant implicit thoughts. These diagrams represent further coding for theoretical outcomes. The central phenomenon is "implementation." Hence the question guiding the process is what events led towards implementation? In this process, there was a lot of going back and forth between the coded documents,the identified open and axial codes to understand how the main categories relate. Here it is also event that every emerging main category was not used.

The processes are expressed diagrammatically. Detail explanation of the relationships are made in chapter 9

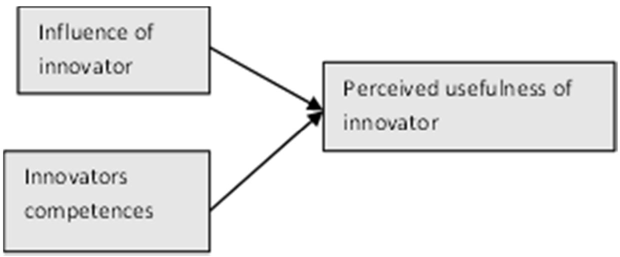
Appendix G.1 Selective Coding for Developed Countries

In this section, the theoretical sampling is done individually for each developed country case. The section ends with a cross-case theoretical sampling to identify the implementation model for the developed countries.

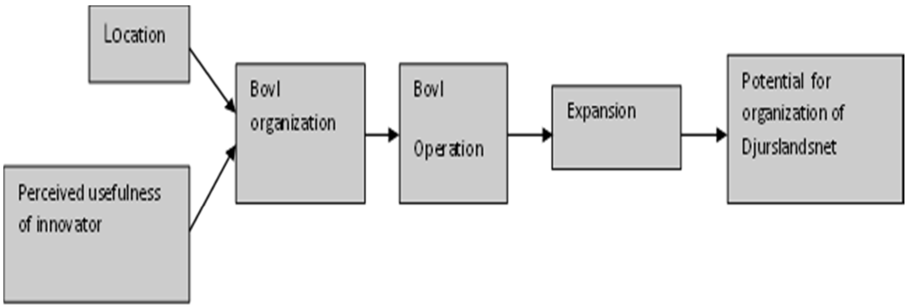
Appendix G.1.1 Selective Coding for DjurslandsNet

The evolution of Djurslandsnet occurred in phases. Hence, to understand the process and identify the ultimate phenomenon, Implementation, the different phases had to be extracted from the Axial code (main category).

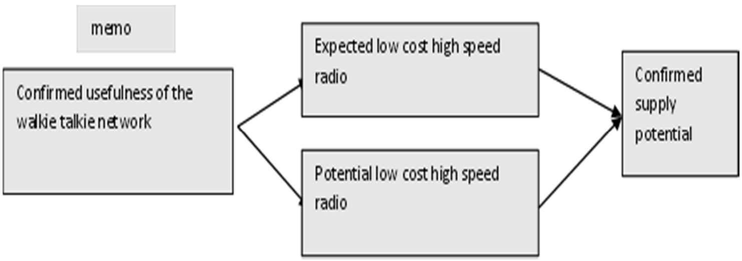
Process 1: (Why was Bjarke (the innovator) useful to the group?)



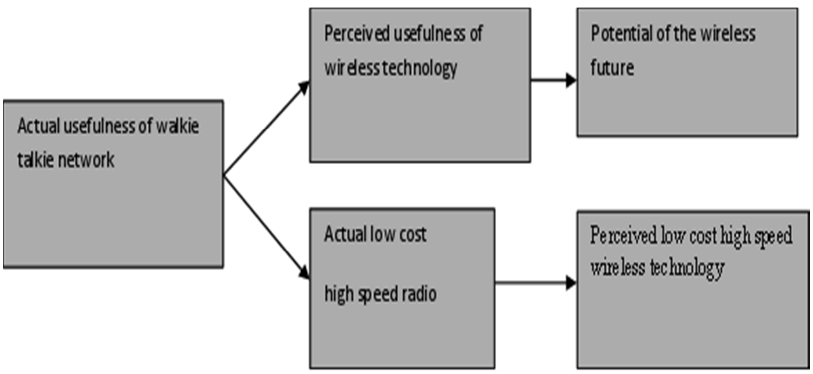
Process 2: Bovl (organization, inspiration)

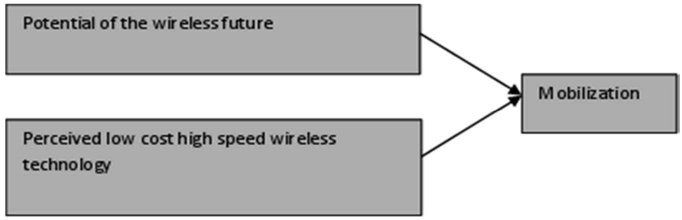


Process 3: Walkie talkie network (external of bovl), innovators personal experience with external actors

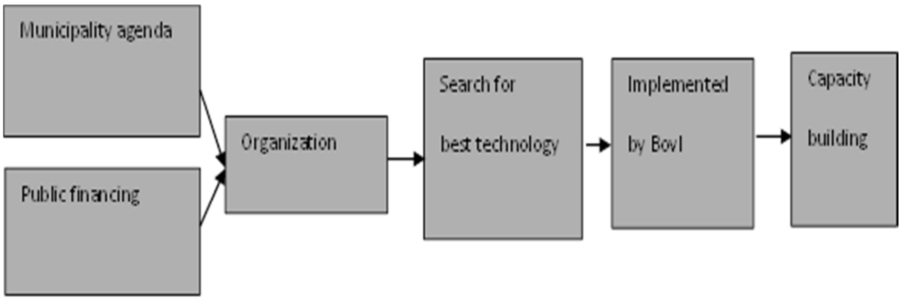


The consequence of process 3

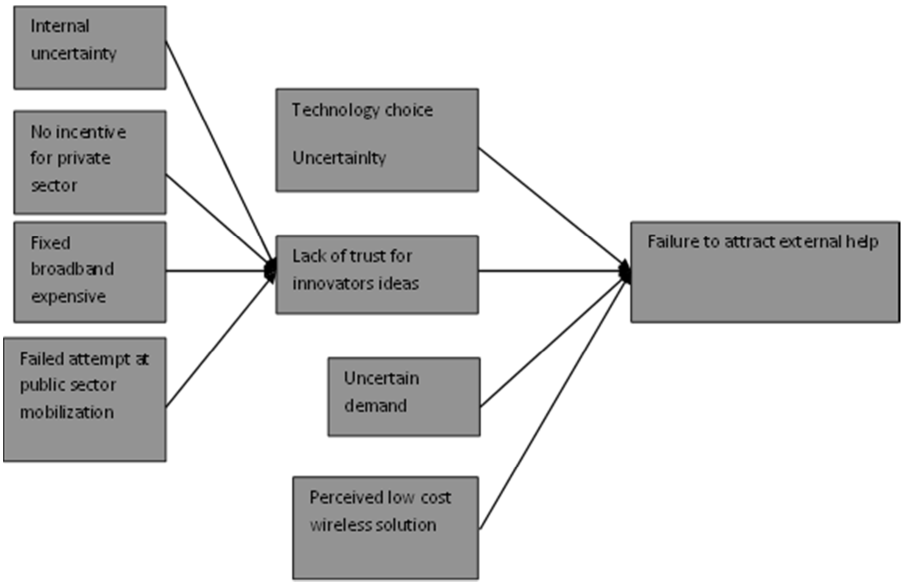




Process 4 The effect of municipality project on Bovl

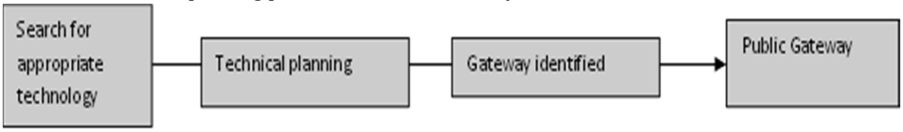


Process 5: Failed external help

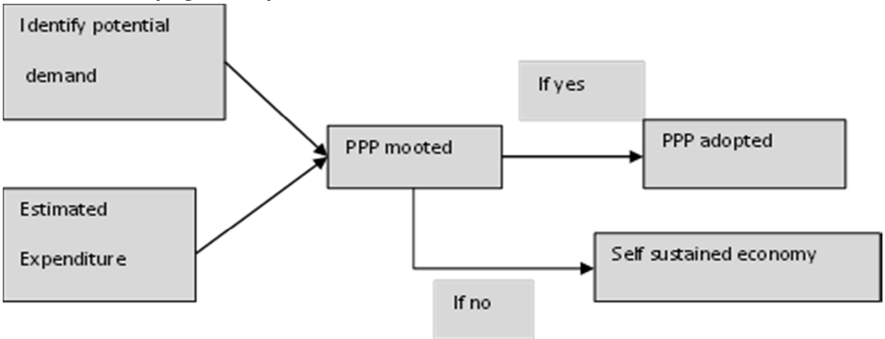


Process 6 dealing with failed help and moving forward

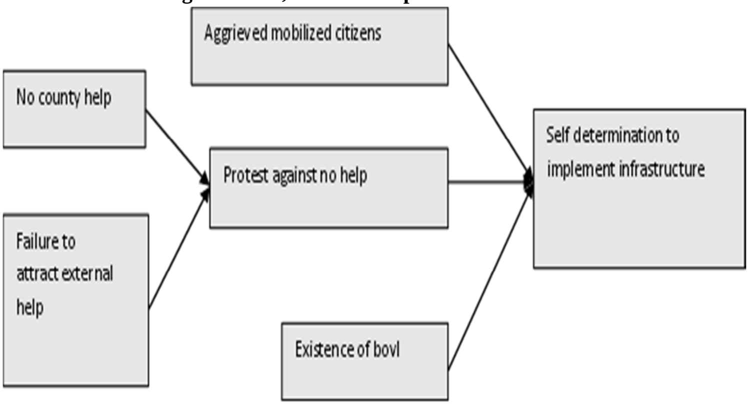
A. Technical planning process, technical feasibility

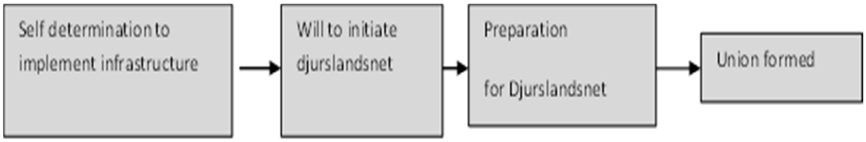


B. Identifying economy

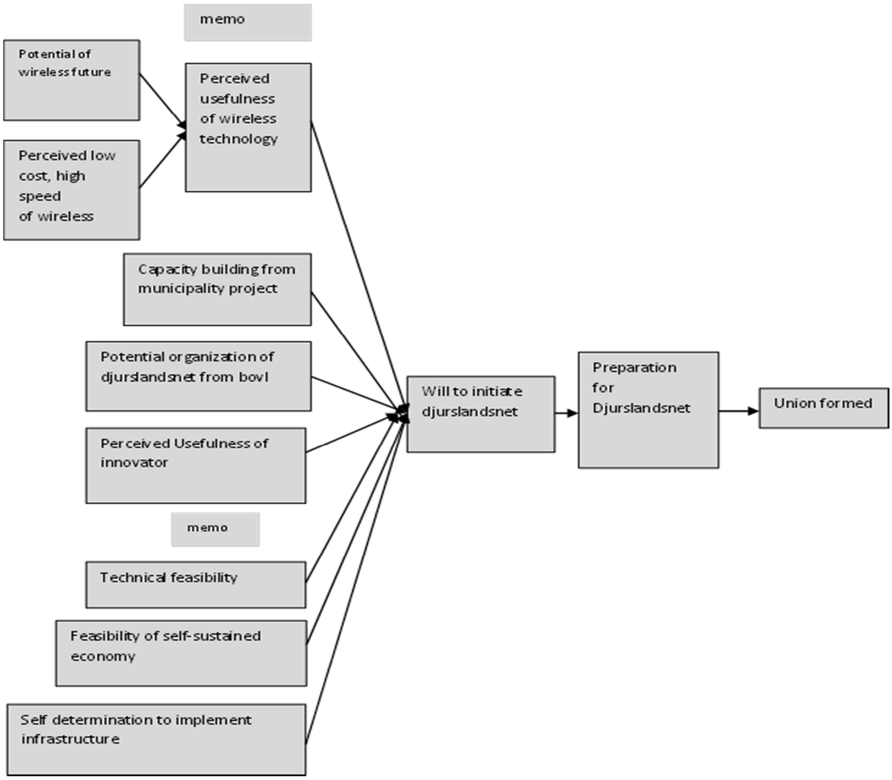


C. Reason for self organization , when the hope for a PPP died

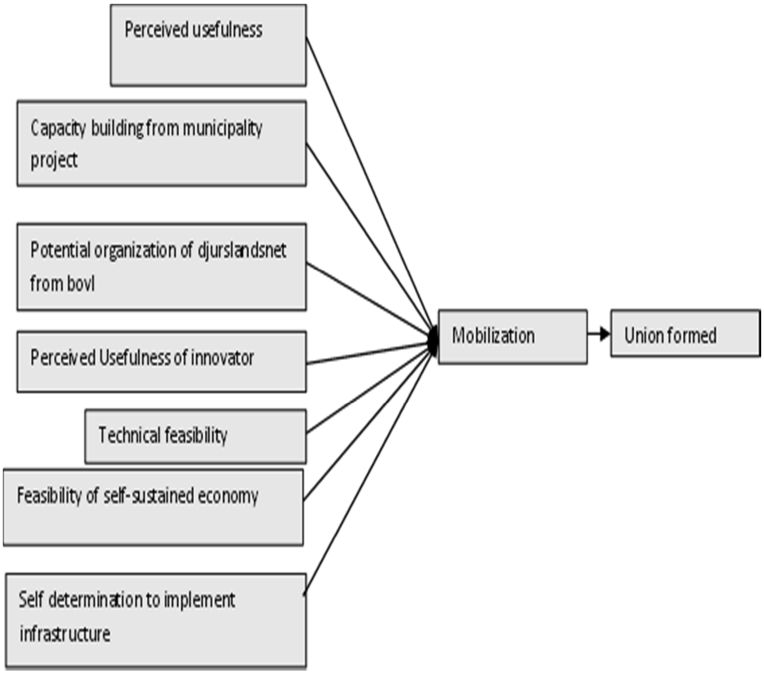




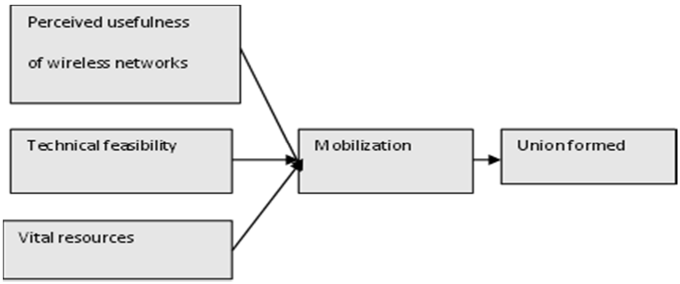
Process synthesis



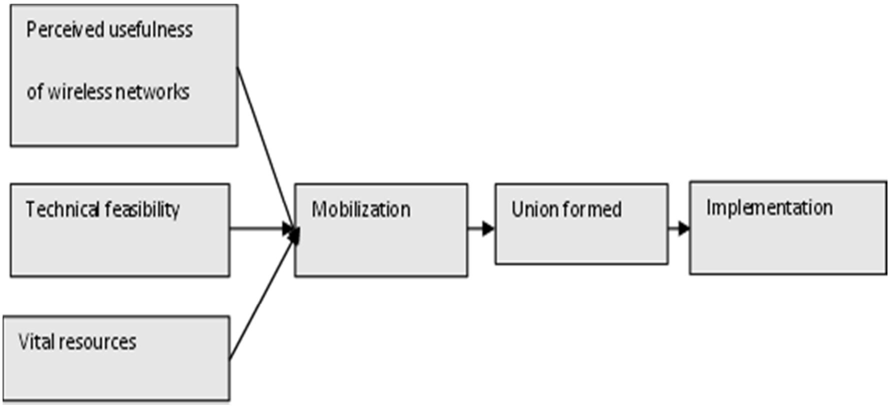
The Will to initiate and preparation for Djurslandsnet can be seen as a form of mobilization.



The ‘perceived usefulness of the innovator’, ‘feasibility of a sustained economy’, ‘self-determination’, ‘potential organization of Djurslandsnet from bovl’ and the ‘capacity building from the municipality project’ are V**ital resources** that aid the development of the network.

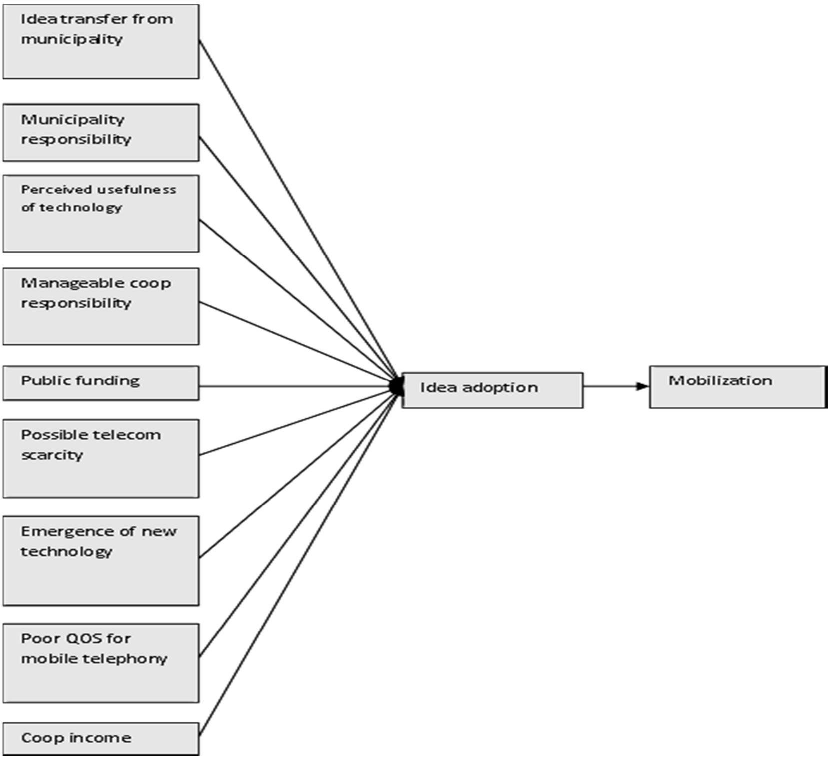


Theoretical outcome

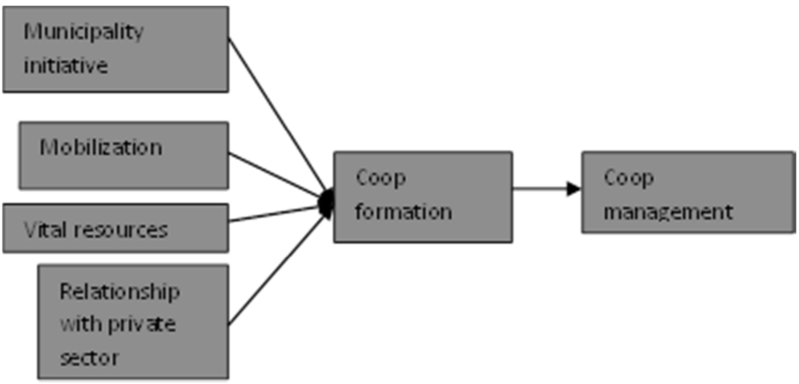


Appendix I.1.2 Selective Coding for Hallary Broadband Coop

Process 1: Coop Adoption of idea from municipality



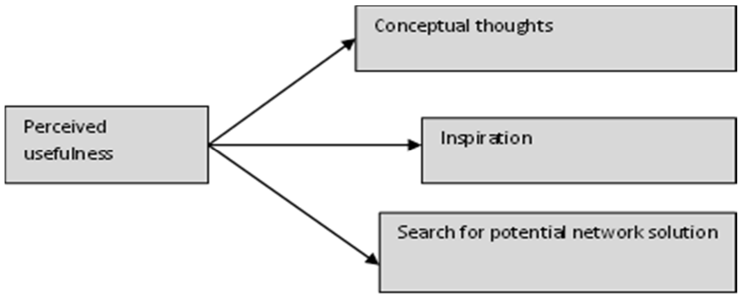
Process 2 Coop Formation and Implementation



Appendix G.1.3 Selective Coding for Magnolia Road Internet Coop

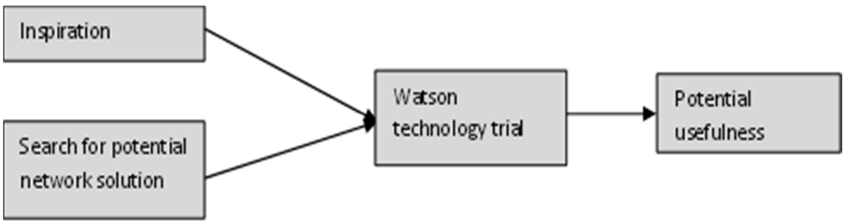
Process 1: Initial thought of deployment possibilities for internet solution for Magnolia Road.

In connecting the axial codes, the first point of thought was the activity at the PPHCP meeting aimed at facilitating high speed internet. This led to process 2, the search for adequate technology



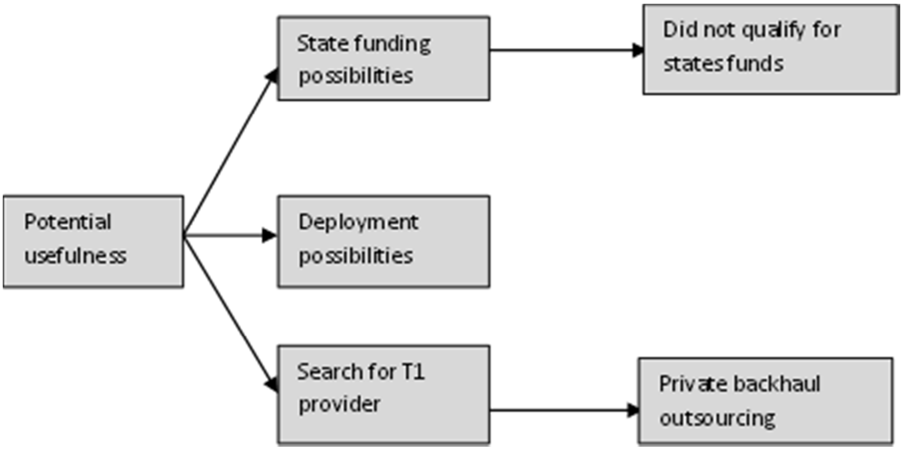
Process 2: The trial of a technology whose capacity they did not know

The Axial code relationships for process 2 were as seen below



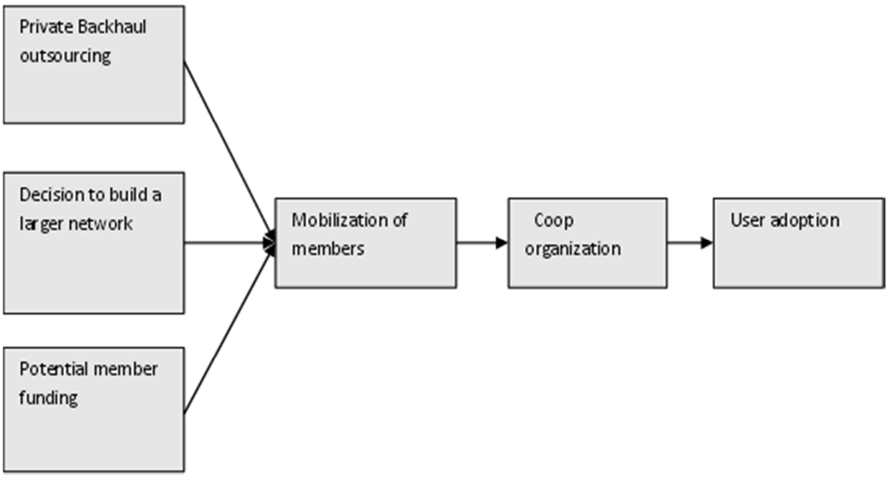
Process 3: The potential usefulness triggered the following process

The potential usefulness of the technology triggered the following actions



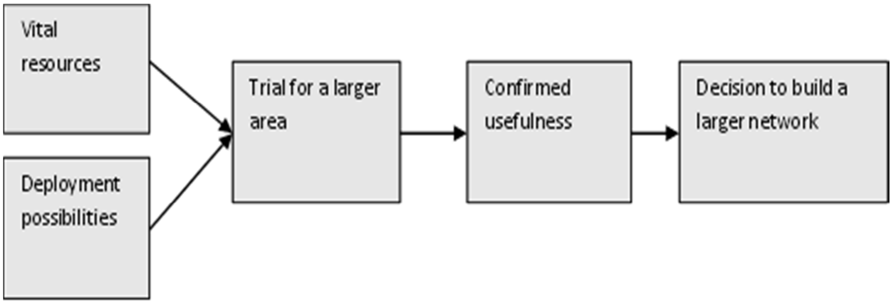
Process 4: Experimentation or trial over a larger area

Although the state funding possibility failed, the decision to build a larger network became possible as a result of potential member funding and the backhaul network private outsourcing possibility. Hence the innovators decided to experiment over a large area.



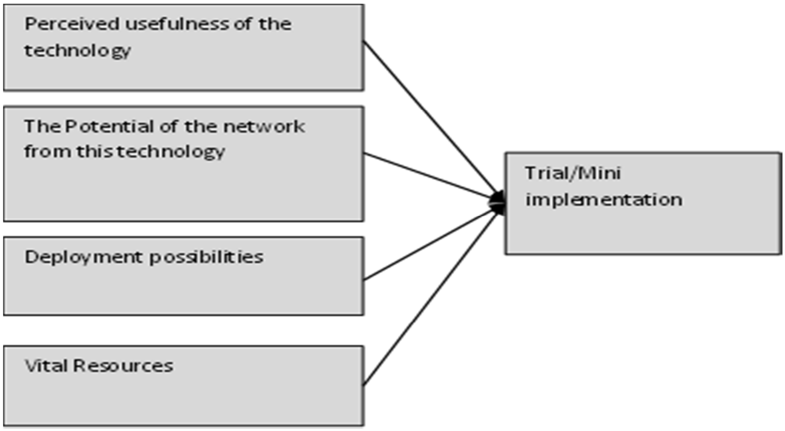
Process 5: Decision to build a bigger network

The processes so far, proved that they had vital resources and that there was deployment possibilities.

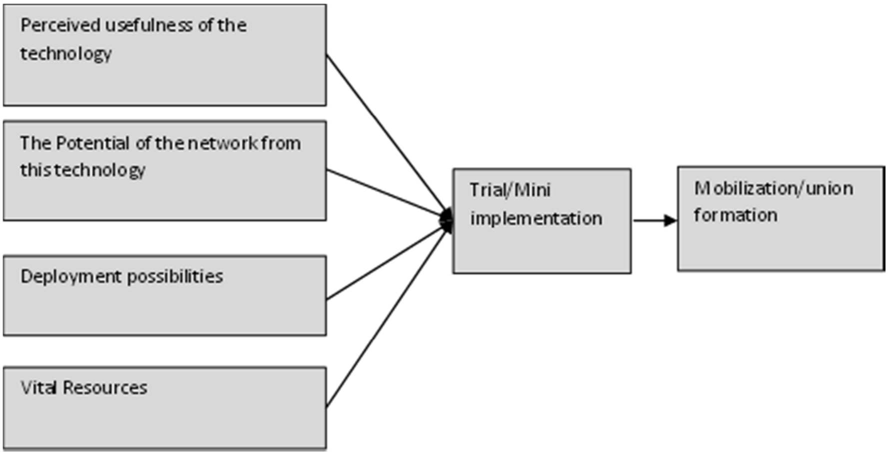


Process 6 : Beginning of theoretical sampling

The processes so far also indicate that the bandwidth capacity (potential of the network from the technology) and the perceived usefulness of the technology were very vital to trials or mini-implementations. Hence.

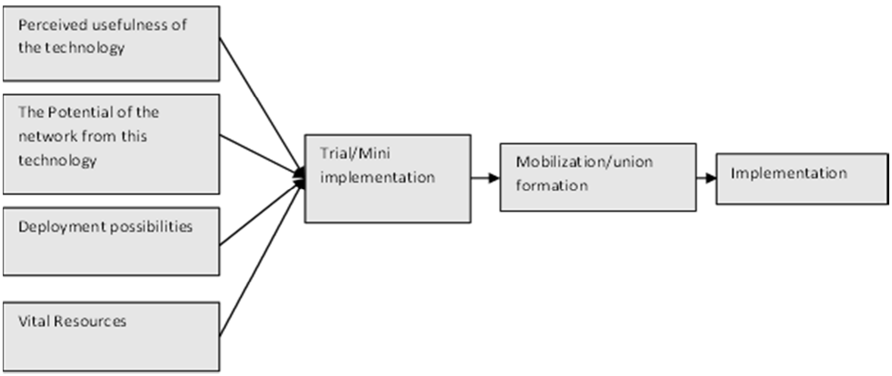


A successful mini-implementation process led to the mobilization of active subscribers



The network grew as subscribers signed on leading to the theoretical outcome

Theoretical outcome

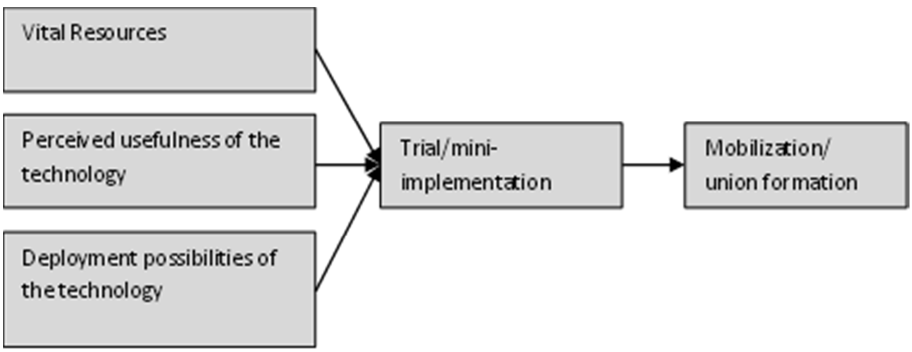


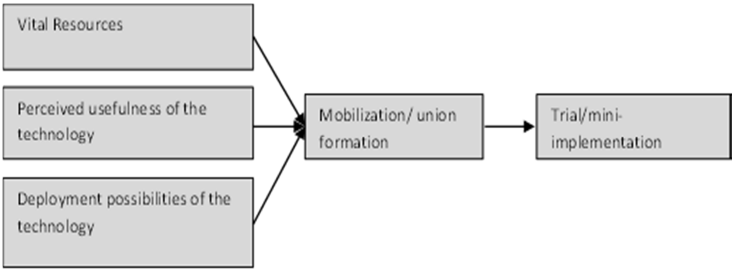
Appendix G.1.4 Cross Case Selective Coding for Developed County cases

Common Causal Factors extracted from the three cases are

Common variables	**Fixed Broadband coop**	**Wireless Broadband Coop**	
	Hallaryd coop (Sweden)	Magnolia road (USA)	DjurslandsNet (Denmark)
Vital resources	Vital resources	Vital resources	Vital resources
	mobilization		
	Relationship with private sector		
Perceived usefulness of technology	Municipality initiative	Perceived usefulness of technology	Perceived usefulness of wireless network
Deployment possibilities	Municipality initiative	The Potential of the network from this technology	Technical feasibility
		Deployment possibilities	

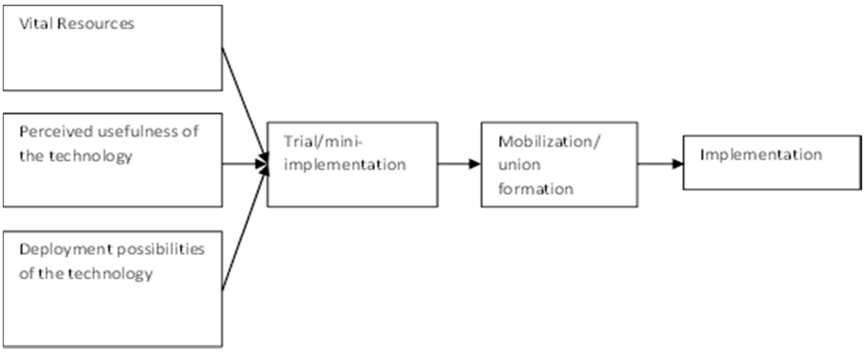
Common Action/interaction Process identified from the table are presented diagramatically below

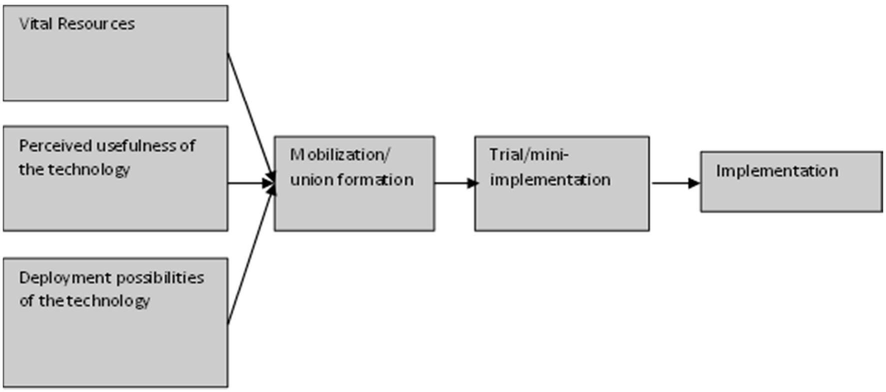


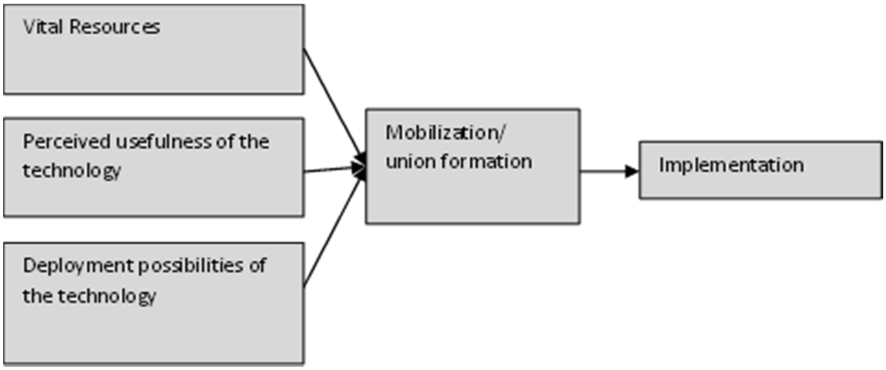


Theoretical Implementation Outcome

The possible implementation scenarios emerge. However the possible scenarios are as a result of the interchange between mobilization and trial/mini-implementation. The third possible scenario is that of mobilization without trial.






Vital Resources
Perceived usefulness of the technology
Deployment possibilities of the technology
Mobilization/ union formation
Implementation

Appendix G.2 Selective Coding For Developing Countries

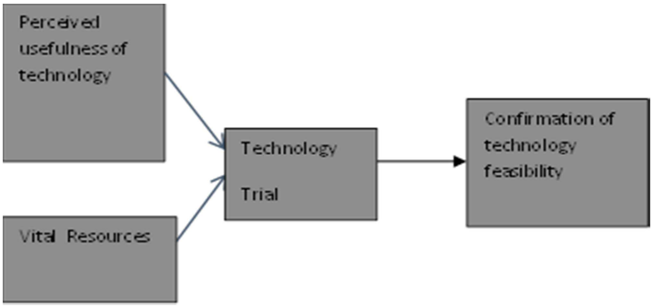
In this section, the theoretical sampling is done individually for each developed country case. The section ends with a cross-case theoretical sampling to identify the implementation model for the developed countries. Detailed description is made in chapter 9.

Appendix G.2.1 Selective Coding for JAWUG

Innovators' decision to embark on their personal project and later larger projects. This can be identified via 2 processes of each Actor network. Once both processes in each phase are identified, the network grows. The processes were aimed at identifying positive consequences that would prompt implementation.

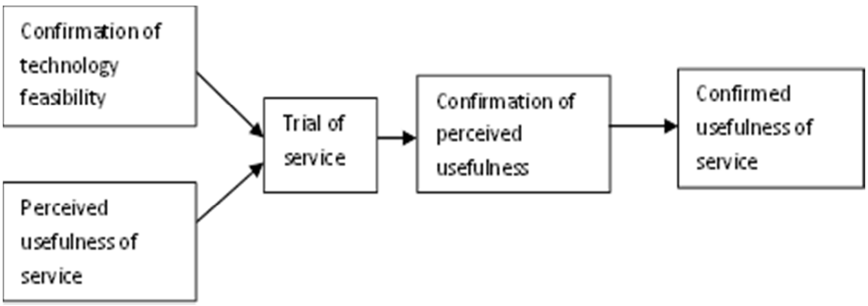
Process 1: **Test for technology feasibility**

This occurred in the three stages of development of the network from the Geek network to JAWUG

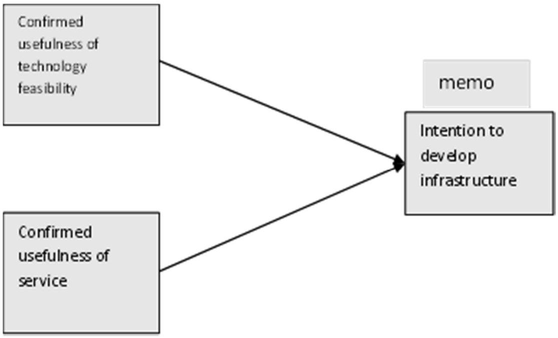


Process 2: This occurred in 2 phases

A. Test for service usefulness

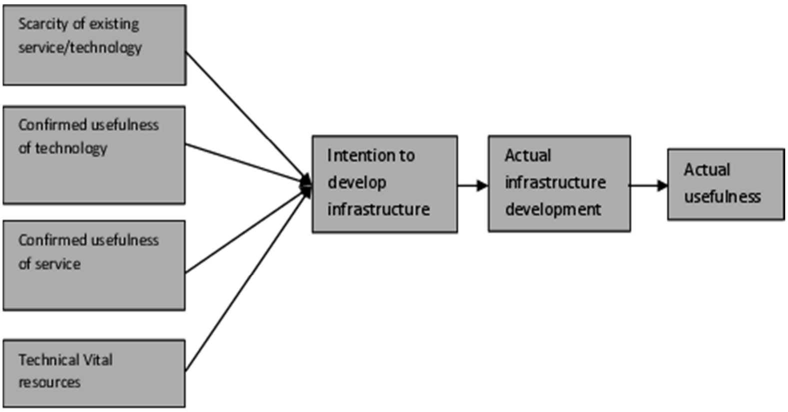


In order to understand each process, it was important to identify how the consequences, namely "confirmation of technology feasibility" and "confirmed usefulness of service" leads to the central phenomena. The outcome of this thought was the identification of what events or implicit thought, these consequences triggered.



However, knowing the "confirmed usefulness of the service" and the "confirmed usefulness of the technology" was not enough to push the intention towards the actual infrastructure development. In reading through the interviews and the codes, it was clear that their desire to search for the usefulness of the technology were driven by the fact that the technology and service were scarce and they had the "necessary (vital) resources" to carry out the test. Hence, as seen in the figure below, these four variables led to the intention to develop the infrastructure.

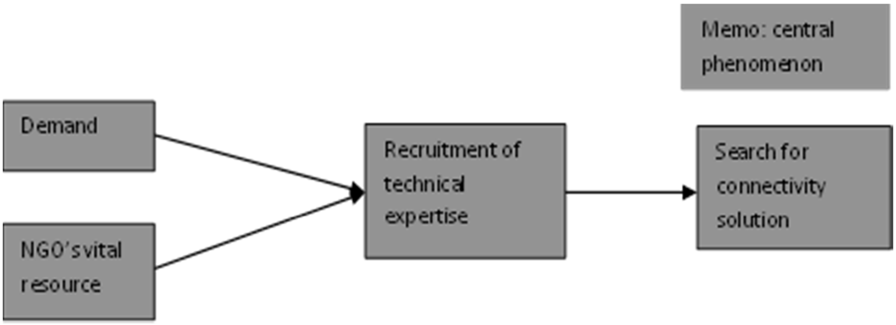
Theoretical outcome



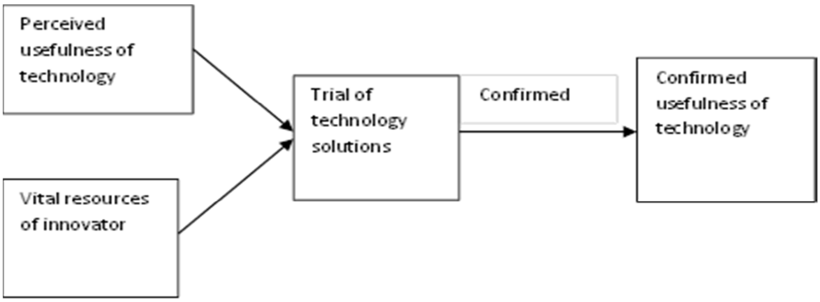
Appendix G.2.2 Selective Coding for Pre-Commercialization of AirJaldi

In this case, implementation at each were triggered by 2 events or processes. The first process was an indirect attempt at finding a solution. The second process was a direct attempt at finding a solution.

Process 1: NGO’s quest for connectivity

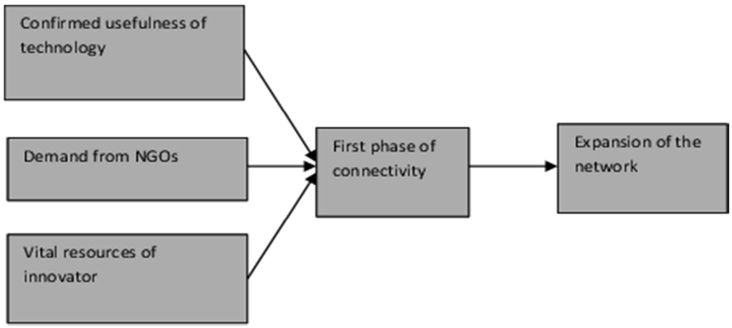


Process 2: Innovators search for technological solutions



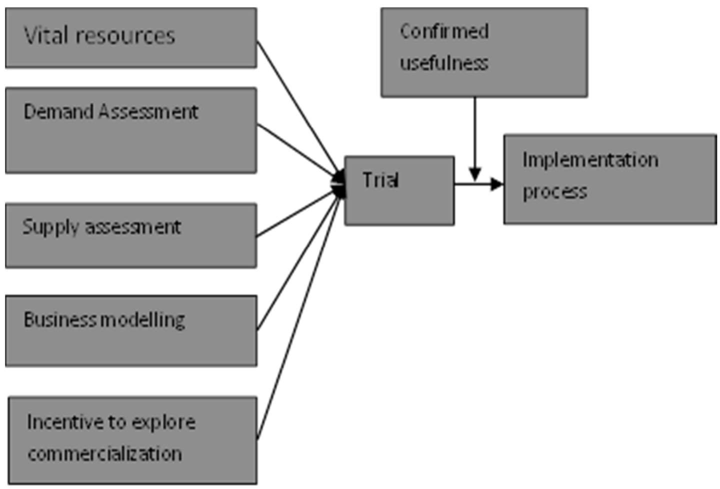
The consequences of both processes empowered the innovator to facilitate the first phase of connectivity. However, the innovator was propelled by the presence of existing demand. The first phase of connectivity here as seen in the figure below, denotes mini-implementation.

Theoretical Outcome



Appendix G.2.3 Selective Coding for Post-Commercialization of AirJaldi

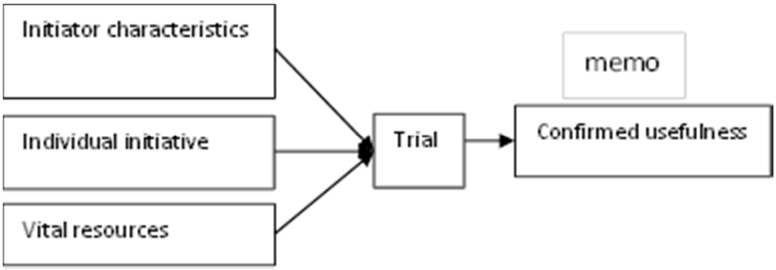
When investors became interested in the network, direct answers extracted from the interviews and Axial codes indicate that the investors had the vital resources, the business model and the existence of an already established infrastructure provided the incentive to explore commercialization. However, Yahel's network was a small network, hence expanding it needed demand assessment and supply assessment (to ensure that the network can be sustained). To ensure sustainability, they had to conduct trials in different areas to test the level of adoption. This test is named "confirmed usefulness" in the figure below. A positive outcome in the trial led to the implementation process.



Appendix G.2.4 Selective Coding for Wireless Ghana Project

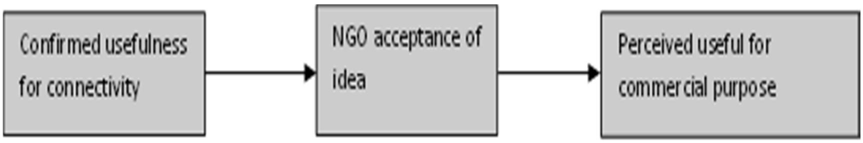
Two processes produces consequences that became causal factors towards implementation of the Wireless Broadband infrastructure. However , as seen below, these consequences did not occur independently. Rather the first consequence which was the “confirmed usefulness of the technology was needed to convince the NGO administration.

Process 1: Persuation the NGO admin



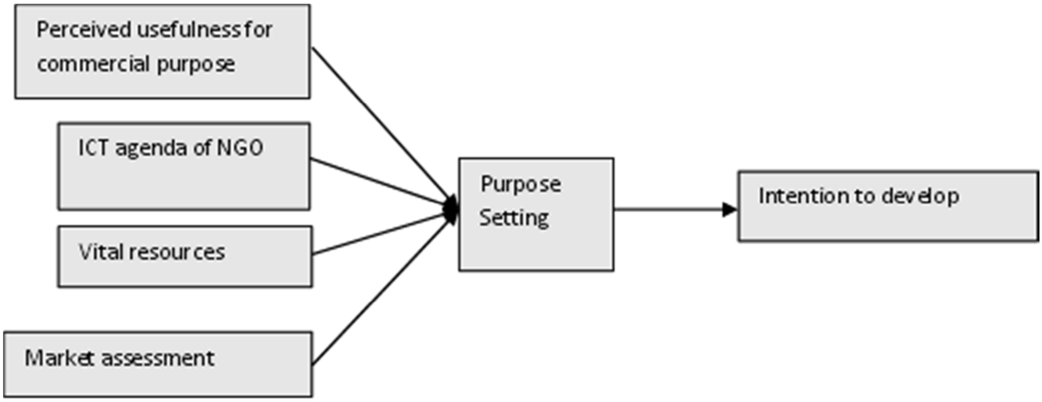
However, the NGO had to see the commercial usefulness of the network. This is identified as the intermediate process.

Intermediate process: NGO acceptance



Once the commercial prospects of the network became visible, based on customer interest, the NGO had to be convinced that the network was sustainable.This led to process 2

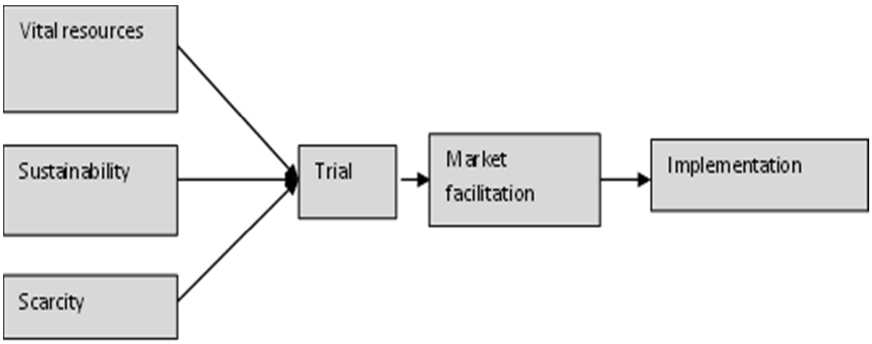
Process 2: Sustainability test



The following codes were identified from the Axial coding process as variables that convinced the NGO to set the purpose for the network. Purpose setting was only adopted once sustainability of the network was certain.

Theoretical outcome

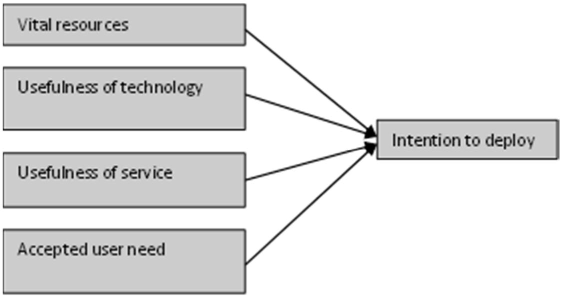
The theoretical outcome is based on the synergy between the two processes



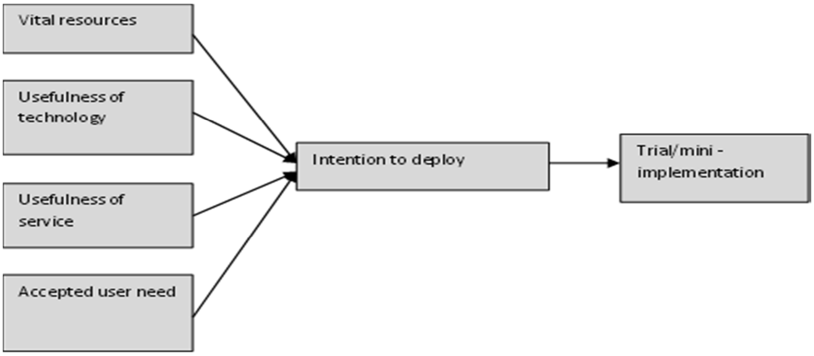
Here the NGO had to be certain that the people felt the scarcity of the service, the service would be sustainable and that the NGO had the vital resources to facilitate the network. They had to be convinced by trial results brought by the innovator.

Appendix G.2.5 Cross case selective coding for developing countries

Common Causal Factors identified in the process are identified below. The process of arriving at this decision is explained in chapter 9. In all the cases, it was common that they needed these causal factors to convince them to deploy the service.

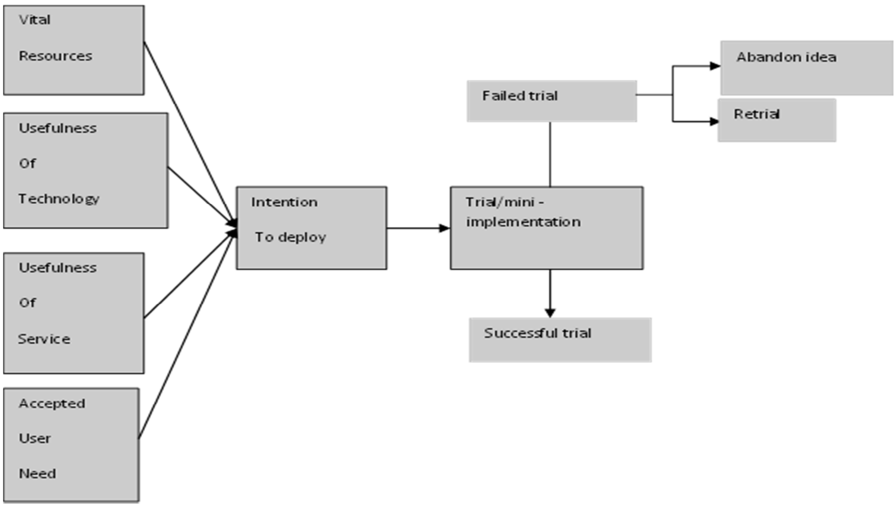


The intention to deploy led to some trials or mini-implementation. This was needed to test the feasibility of the network.



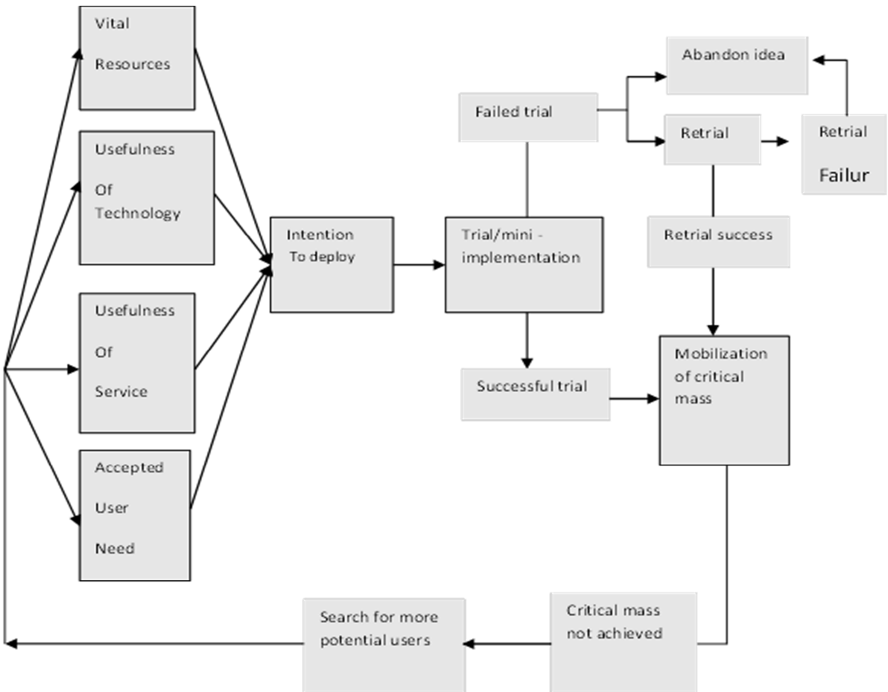
In the 3 cases as explained in chapter 9, the trial phase was not the main implementation. Rather, it was the make or break point towards implementation. Below an attempt is made to visualize the scenario that actually leads towards implementation. This process as identified from the coding became necessary due to the poor economic condition.

Evolution of the Actions/Interaction

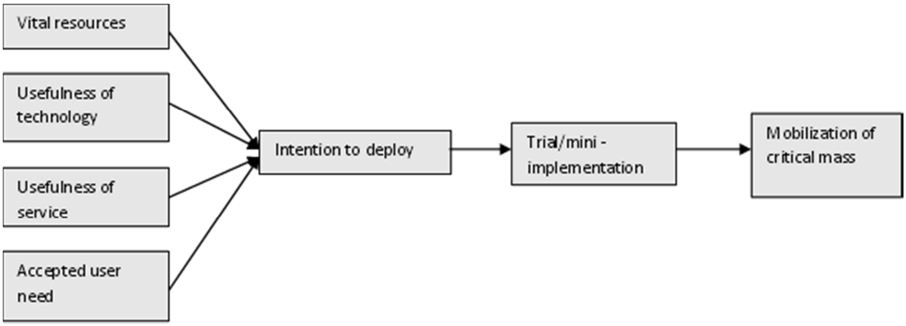


The success of the trial, led to mobilization as seen in the figure below

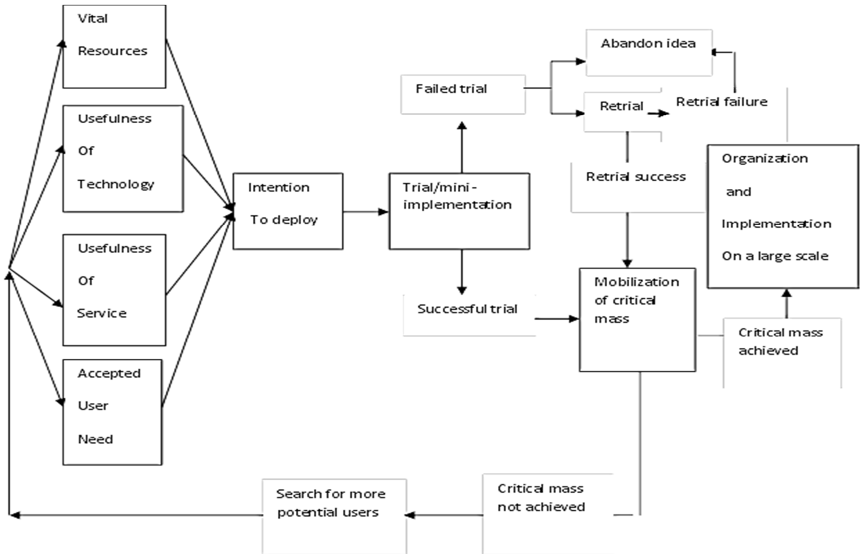
Mobilization Process



Mobilization was made possible by the existence of the network, the type of service provided. It was also made possible when people saw that the innovators had the vital resources to implement the network, hence they had trust in the innovators. They also saw how the network will fit into their lives. Based on these findings, from the axial codes, the causal factors hold, hence the iteration continues.Hence the theoretical outlook reflects thus.



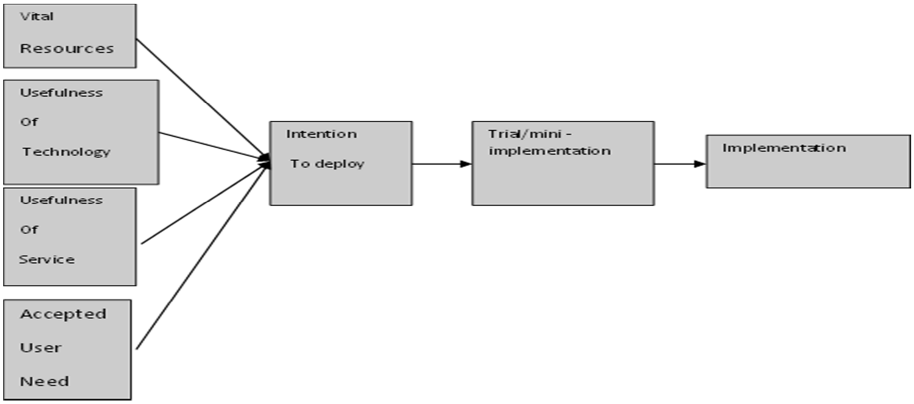
Iteration to achieve critical mass, aimed at the implementation

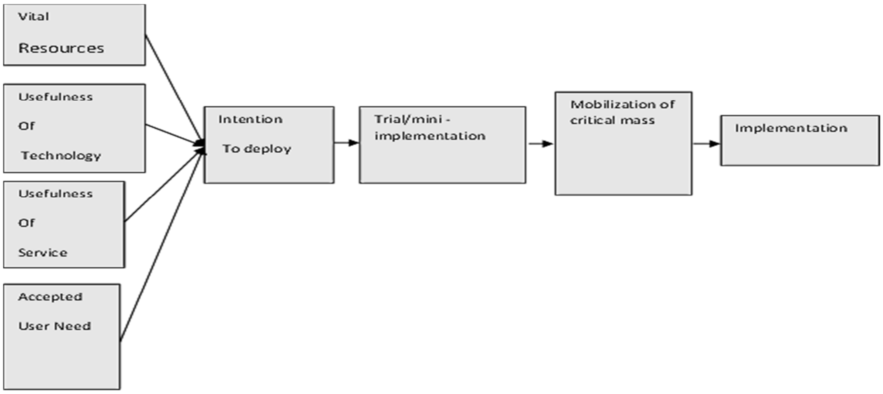


Once critical mass was achieved, one could see the theoretical outcome as seen below.

Theoretical outcomes

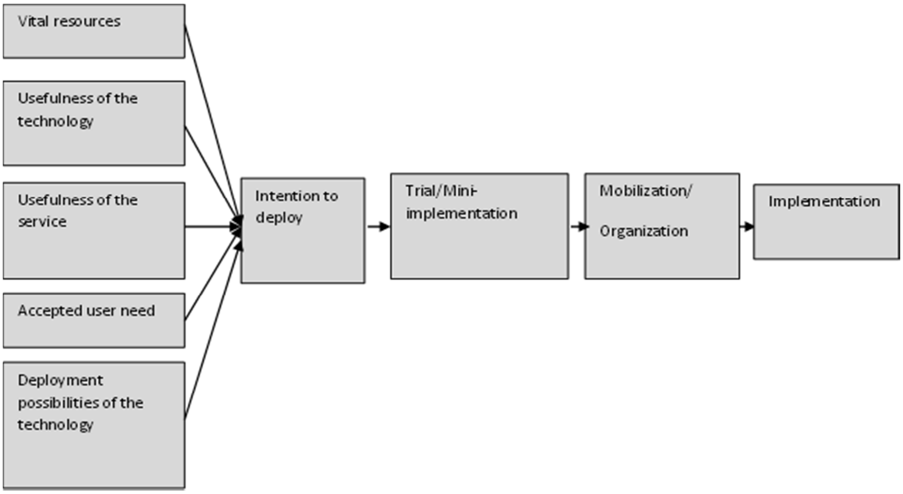
There are 2 theoretical outcomes. The first possible outcome is a direct implementation after a convincing trial. The second possible outcome involves implementation after mobilization as seen in the figures below.





Appendix G.3 Cross Case Analysis between the Developed and Developing country cases

In the bid to identify a grand model for rural Broadband development, the causal factors for the developed and developing country cases were merged. The same was done for the action/interaction processes.

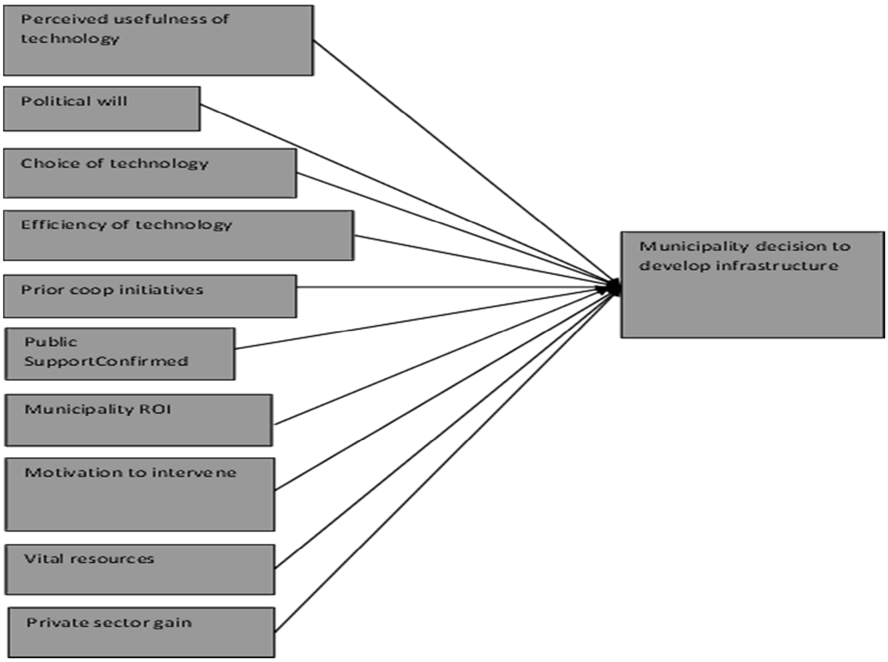


Appendix G.4 Selective Coding for Public Initiative (Developing case2)

Two processes were identified in this case. These processes were dependent on each other. The first process contained was the factors that led to the municipality's decision to implement the infrastructure. The second process contained other factor, that did combine with the municipality's decision leading to the actual infrastructure delivery.

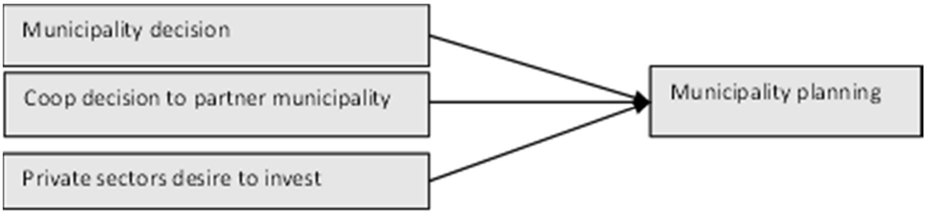
A. Municipality Planning process

The inspection of the odes began with the quest to trace how the municipality planned the process. In the bid to understand the municipality's planning process it was important to find out why the municipality decided to develop the infrastructure?



For the identified factors to emerge, it was important to find out what made the satiation conducive for the factors to emerge

Conducive factors that led the municipality to develop the infrastructure

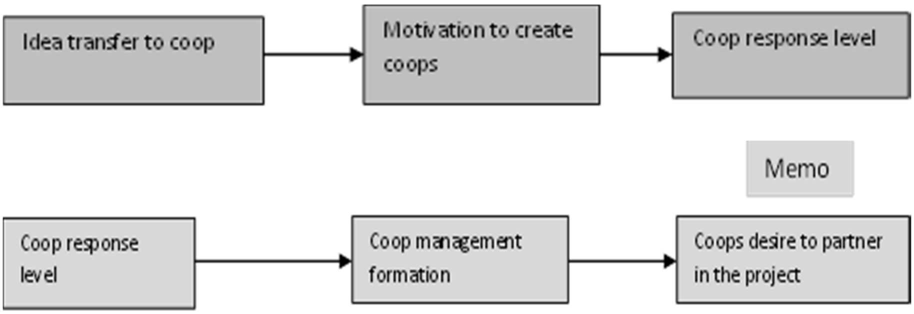


There were some coops that were planning to facilitate FTTH. Hence the municipality decision was a welcome development. The private sector also saw a business case. Based on this fact the factors that led to the municipality's decision became conducive as the municipality could see the prospects for implementation. Hence the municipality decided to develop the partnership plan tween the three sectors.

This reality, as identified from the coding process led to the municipality selling the ideas to the coops to get them on board

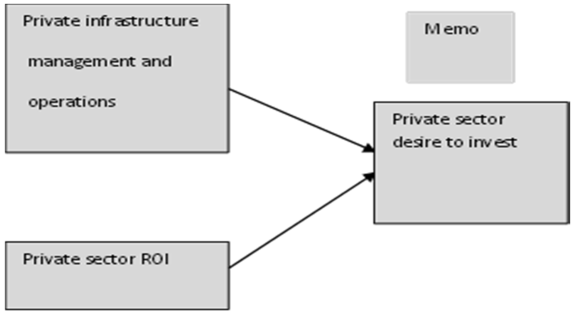
Idea Transfer process from municipality to the Broadband coops

The idea transfer process as mapped from the codes is presented below.



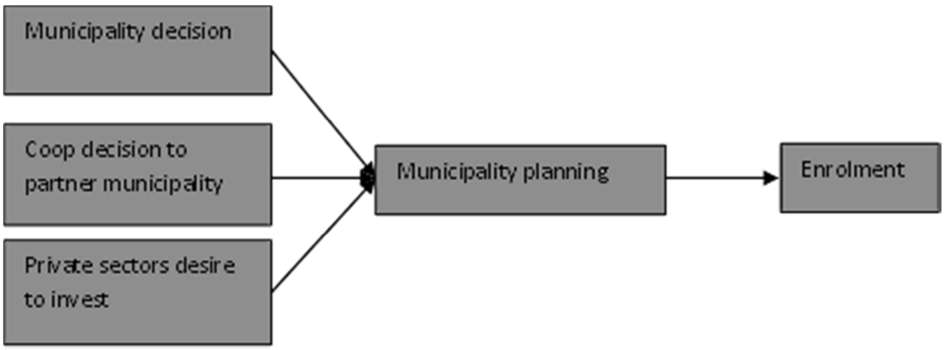
Private Sector Interest and Enrolment

The combination of the following Axial codes produced a new code from a memo on the consequence of the combination as seen in the figure below. It portrays the factors that influenced the interest of the private sector in the facilitation of infrastructure.



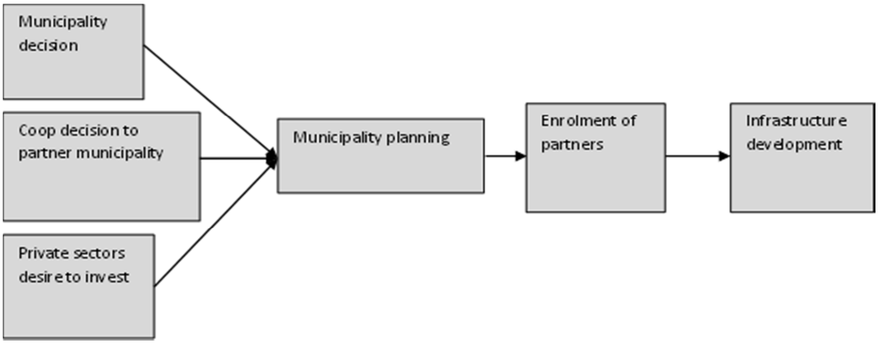
If one returns to the axial code relationships portraying the conducive factors that led to the municipality planning, one would realize that the model presents causal factors to an action (municipality planning). From this action, one can begin to trace the actions that led to implementation

B. Municipality implementation Process

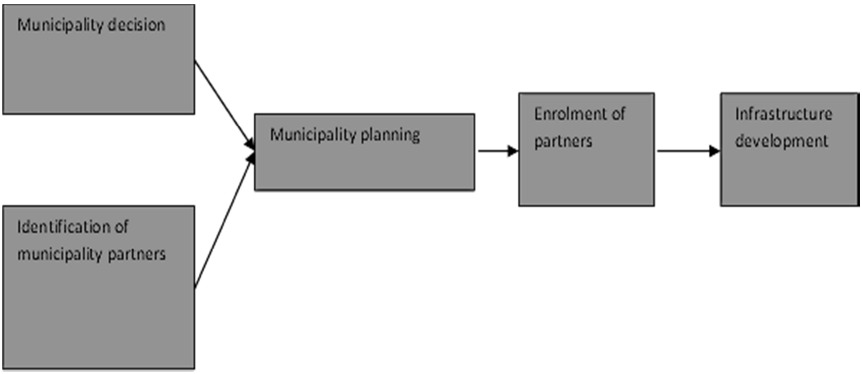


In process A, it was glaring that once the municipality saw the opportunity of partnering with the people and the private sector, they enrolled the coops and the private sector to aid in facilitating the project. Based on this line of thought, the theoretical outcomes below was realized.

Theoretical Outcome



The second theoretical abstraction below was developed with the assumption that the municipality did not know its parters



SUMMARY

In recent times, rural communities around the globe have been involved in the facilitation of Broadband infrastructure delivery. In this report some of these initiatives from Ghana, USA, South Africa, Denmark, Sweden and India are studied. The essence of the study was to understand how more of these initiatives can be facilitated around the globe using Public Private Interplay. This initiative will supplement current market efforts facilitated by the Public, Private or a combination of Public-Private effort to facilitate Broadband Internet infrastructure Globally. The outcome of this report was the development of PPI models that can facilitate the facilitation of rural Broadband internet infrastructure in rural areas globally and in the specific potential deployment cases - Ghana and Nigeria. This report is relevant to National policy makers, International Donor Agencies, Telecom Network operators and relevant Broadband market stakeholders.

The topics discussed in this report includes:
Public-Private Interplay
Public Private Partnership
Universal Access and Services
Broadband Internet Infrastructure
Stakeholder Theory
Actor Network Theory
Grounded Theory

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